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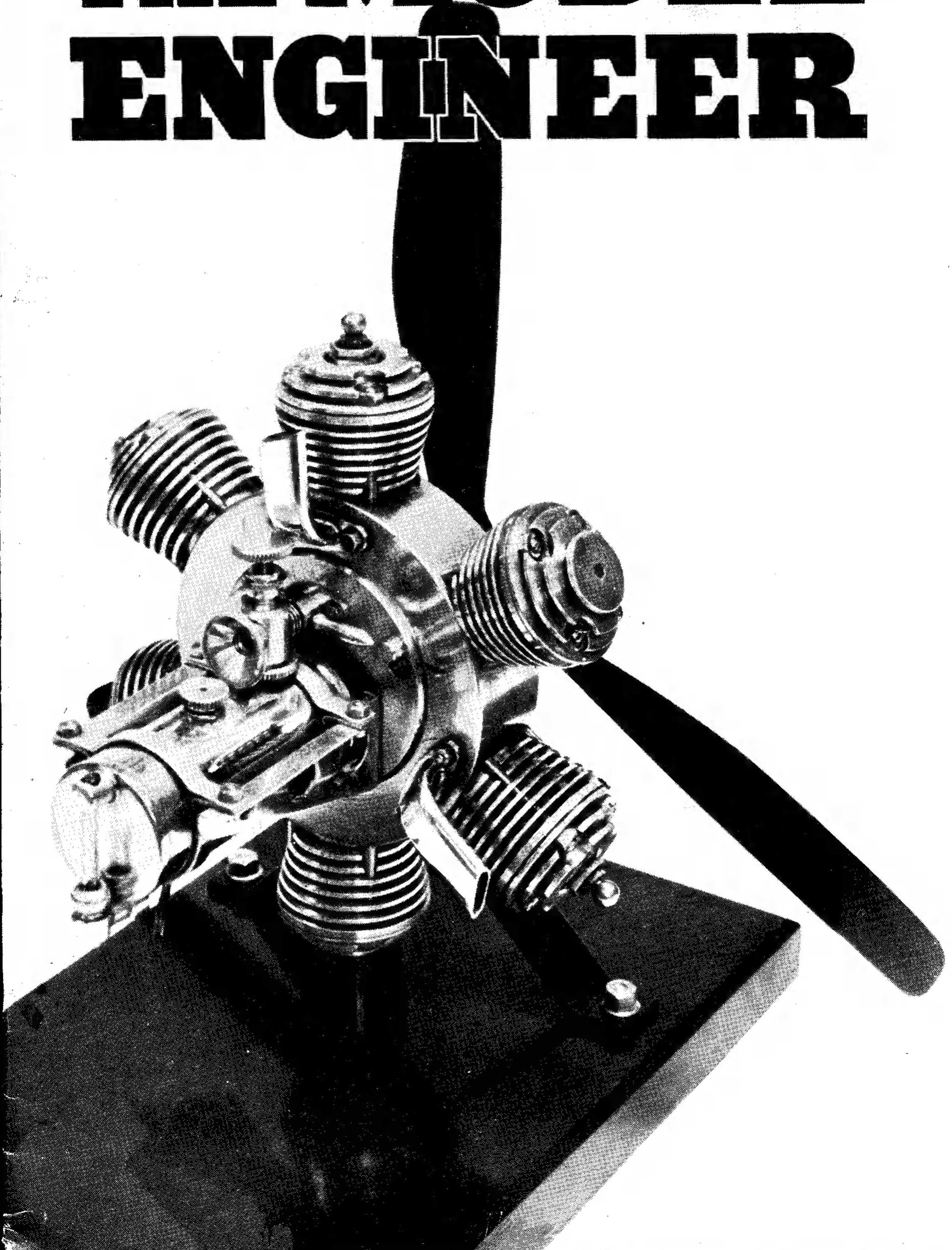
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

20TH SEPTEMBER 1951 VOL. 105 NO. 2626

Smoke Rings 373
Internal Combustion Engines at the "M.E." Exhibition 375
"Operation Brunel" 377
Traction and Portable Engines at the "M.E." Exhibition 378
In the Workshop—Some Motor Car Repairs 382
Workshop Equipment at the Exhibition 386
Brush Painting with Cellulose 390
A Chiming Gear for the Battery-driven Electric Clock 391
"L.B.S.C.'s" Lobby Chat—"Chopping 'em Off" 396
Practical Letters 400
Club Announcements 401
"M.E." Diary 401

SMOKE RINGS

Further Exhibition Conversations

● FOLLOWING UP the paragraph in last week's issue on the subject of remarks overheard at the Exhibition, here are two more which readers may find interesting.

(1) "Aren't these radio controlled boats wonderful?" "Not bad, but it is an old trick really—you see, they do it by magnets underneath the tank."

(2) "What makes these little racing cars go so fast?"

"Oh, they are driven by little 2-stroke engines."

"What are 2-stroke engines?"

"Oh, they are something like the engine we have on our lawn mower."

"Oh, my! I'd like to see our lawn mower going as fast as that."

Redesign of Models

● IN THE course of conversation with visitors to the "M.E." Workshop at the Exhibition, on one or two occasions the point was raised as to whether or not it was a good thing to "convert" old models to new.

The answer to such a question is, of course, that it depends entirely upon the model and its intrinsic value as such in its existing state. One would not, for instance, convert or modernise a really old model of a still older prototype, provided the model was a faithful copy. Were it not, a model engineer acquiring such a model should receive every encouragement to carry out the necessary alterations in order to bring it to the correct stage of authenticity, and many model engineers do, in actual fact, derive considerable enjoyment from the very research that such a procedure entails. In the case, however, of a model such as the horizontal stationary gas engine which was converted in the "M.E." Workshop and which ran daily throughout the period of the show in its new guise as an o.h.v. petrol engine, we feel that there is every justification for conversion and for modernisation. But more about that anon!

Can Anyone Oblige?

● MR. T. DAVIS, 76, Rous Road, Buckhurst Hill, Essex, has written to say that he is making up a parcel of books for the Missions to Seamen, and he wonders if any readers have any copies of old "M.E.s" or technical books to add to the parcel. If any reader has anything of the kind and would care to dispose of it in this way, he is invited to communicate direct with Mr. Davis at the address given.

Found

● MR. FRANCIS S. DAY, 17, Belsize Crescent, Hampstead, N.W.3, has been good enough to write to us as follows:—

"On Parliament Hill, near the yacht pond, I found a pewter mug marked as below:

November Consistency Trail, 1949
W. B. Broadbent

The owner can see me after 7 p.m. any evening."

If the owner should happen to see this note, we leave it for him to take the appropriate action.

A Victory for Radio Control

● A CONVINCING proof of the development which has taken place in the radio control of model boats was provided on Thursday, September 6th, when a model cabin cruiser only 5 ft. long by 2 ft. beam was sailed from Dover to Calais, steered across entirely by radio control without the slightest hitch. The trial was sponsored by Messrs. Electronic Developments Ltd., of Kingston-on-Thames, the engine being their standard Mark IV 3.46 c.c. diesel, fitted with water cooling, and the radio equipment being standard E.D. which has been designed by their development manager, Mr. George Honnest-Redlich. The model was controlled from a 20 ft. cabin cruiser owned by Mr. J. H. M. Gordon, of Hammersmith Models, Hammersmith Bridge Road, the actual controlling of the model being shared between Mr. J. E. Ballard, managing director of E.D.'s, Mr. Honnest-Redlich, and his assistant, Mr. Trevor Owen. The Editor of our companion magazine, *Model Ships and Power Boats*, was also one of the party. Owing to a faulty compass the party got off its course and the crossing took nine hours, a total of 32 miles being sailed before arriving at Calais, thus adding to the severity of the test. Weather conditions were favourable, but even so the seas were quite lively in mid-Channel. A wonderful performance for both the model, its engine and its radio equipment. Our heartiest congratulations to all concerned.

Experimental Locomotives

● WE RECEIVE many letters enquiring about certain experimental locomotives and asking for information as to details of their construction and how they compare with orthodox types. Just lately, enquiries as to the working of the Southern Region's "Leader" class engines have been coming in, and a number of our correspondents, who are visiting London from the provinces and even from overseas, want to know where they can see one of these engines working.

We are afraid we must disappoint these enquirers, for the experiments with the *Leader* were abandoned some time ago and the engine and its sisters are being broken up. The official reason for this is that the design proved to be impracticable for railway service, and we must say we are not surprised.

We are not disposed to quarrel with any locomotive engineer, or his ideas; neither are we against any departure from orthodox locomotive design, provided that they prove to be worth while. But we must confess that, right from the first, the *Leader* did not appeal to us as a practical proposition; for one thing, there were far too many new ideas all in one machine, whereas a saner policy would have been to try them out and perfect them individually before putting them all together on one frame.

Another feature we disliked was the off-centre setting of the boiler. The very first essential in a locomotive of any kind, steam, oil or electric, is that it should be stable on the track, standing as well as when running. To our way of thinking, the setting of its heaviest single feature out of line with the main centre-line of the whole structure is bound to induce instability.

We feel, too, that the use of sleeve-valves, without a considerable amount of preliminary experiment, was a doubtful "improvement"; true, such valves are used with success on many modern aircraft engines, but these are not used with steam.

However, no matter what may be individual opinions of various observers, we shall hear no more of the *Leader*, and we imagine that the most relieved parties are the technical staff of the Southern Region!

Exhibition at Keighley

● MR. HARLAND BROWNLESS reports that the Keighley and District Model Engineering Society's "Festival" Exhibition in Keighley was sponsored by the Keighley Borough Council, in conjunction with local craftsmen, and from the outset proved to be a huge success. It was quite apparent that the public were not aware of the number and the quality of the models on show, and the expressions of appreciation made at the end of the inspection of the exhibition proved that the work entailed prior to the exhibition had been well worth the trouble.

Over 50 models were on show, all of them, with one exception, being made by the members of the society, the exception being a model, over 50 years old, of the original engine installed in the works of Messrs. Dean, Smith, and Grace Ltd., the famous lathe manufacturers, of Keighley. This model and others were working under compressed air.

Mr. Douglas Miller, M.B.E., president of the Brighouse Society, and Mr. Harry Byram, of Brighouse—in the absence of Dr. Fletcher, of Colne—judged the exhibits.

Dominating the steam stand was a 5-in. gauge L.M.S. "5XP" locomotive jacked up and working under compressed air; but, quite perky, immediately underneath was a Gauge "1" "Wee Dot" locomotive. The comparison was very obvious and was remarked upon.

A number of chassis under construction were shown, and at the end of the same stand a panel of workshop exhibits, including a lathe bed and lathe accessories were shown, which had been constructed in the Keighley Technical College workshops by members since the society was formed.

The aircraft stand was very busy; the exhibits here were varied.

The marine stand was unique in the fact that all the members had commenced their models since the formation of the society—just over a year ago.

At each end of the marine stand were two large models. One, a Brooke marine cruiser, winner of a bronze medal at the London "Model Engineer" Exhibition in 1948, and the other a model under construction of a 41 ft. Osborne "Eagle" cruiser, with its fittings. Both these models were to a scale of 1 in. to the foot.

A number of professionally-made railway "O" gauge models were loaned for the exhibition. They were on a stand by themselves and aroused a great deal of interest.

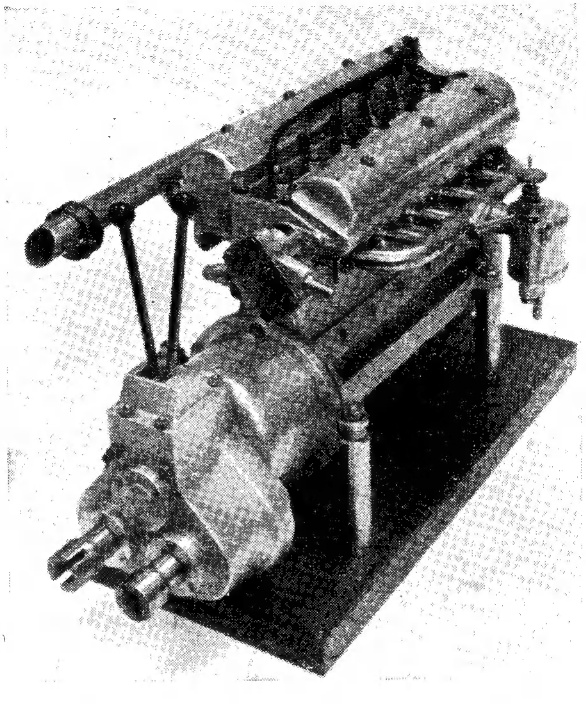
When the exhibition closed, it was very satisfying to find that 18 people had applied for membership.

Internal Combustion Engines

at the "M.E." Exhibition

THE display in this section of the exhibition was better than it has been for several years, in respect of both variety and quality of workmanship. Most of the engines were either of original design, or embodied some additions or improvements devised by the constructor to suit some particular purpose.

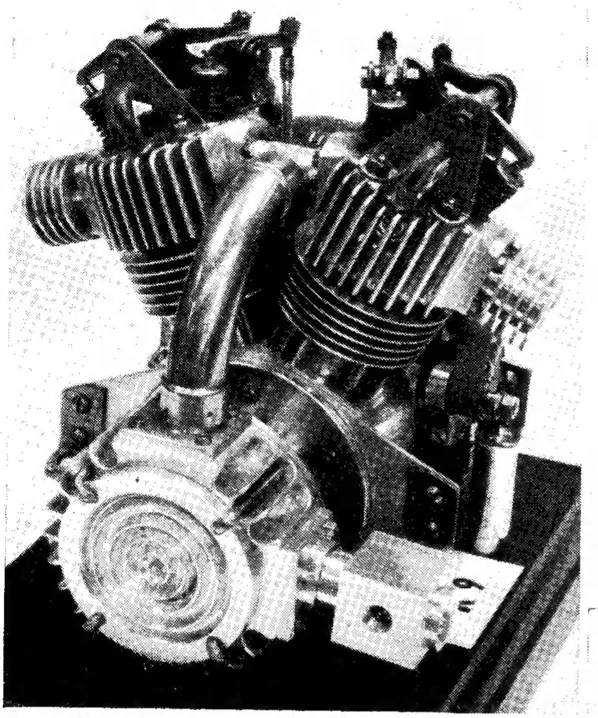
One of the most ambitious designs, which at the same time is fully practical, is the 30 c.c. 6-cylinder twin overhead camshaft engine by Mr. F. W. Waterton of Stretford. This engine is the result of several years' work and a considerable amount of experience in the running of small petrol engines, as Mr. Waterton is an active member of the Altrincham Model Power Boat Club, and has built several engines, both for prototype and racing boats. The present engine is presumably intended for driving a boat, and is fitted with transmission gear to drive two propeller shafts, with clutch control and reverse gear. The engine itself is of monobloc construction, and has a 7-bearing crankshaft with split main and big-end bearings. The cylinders are fitted with liners, and the inclined valves are driven by separate camshafts operating direct on the valves. A float feed carburettor is fitted, and water circulation is effected by means of a gear-wheel pump. One of the most outstanding features of the engine is the magneto, which is quite successful in spite of its diminutive size, including the high tension distributor. This particular class of engine is one which rarely receives the appreciation it deserves, as all the best features of its workmanship are totally enclosed. The exterior gives very little clue to the very considerable amount of work, all of a high precision nature, which is put inside it.



Mr. F. Waterton's 30 c.c. 6-cylinder twin overhead camshaft engine and transmission gear for two propellers

A rather more spectacular type of engine is the 6-cylinder aero engine by Mr. W. E. Reed. Strictly speaking, this is a 3-cylinder engine, as only three of the cylinders are power cylinders, the other three being charging pumps. The engine is of the 2-stroke type and, having a radial arrangement of cylinders, cannot make use of the crankcase for pre-compression of the charge in the usual way, hence the necessity for the charging cylinders. In other respects, the engine works on the normal 2-stroke principle and is fitted with glow-plug ignition. Although no information is available as to the success of the engine as a working model, it would appear to be quite practical, and would be a very useful power unit for a fairly large sized model aeroplane, and a refreshing change from the monotony of the single-cylinder 2-stroke.

Yet another departure from convention is seen in the super-charged 15 c.c. 4-stroke vee-twin engine by Mr. B. Stalham of Kings Lynn. This engine resembles, in its general external features, the type of engine which has been popular in motor cycle and light car practice for very many years, and its details have been very carefully worked out, a particular feature being the geometry of the valve operating gear, which is designed to cope very effectively with the particular problems in actuating two sets of inclined valves. The supercharger is of the eccentric vane type, and is driven by means of a follower crank from the overhung crankshaft of the engine. A flywheel magneto, having a 4-pole magnet adapted from the rotor of a Scintilla magneto, provides for ignition, and a carburettor having



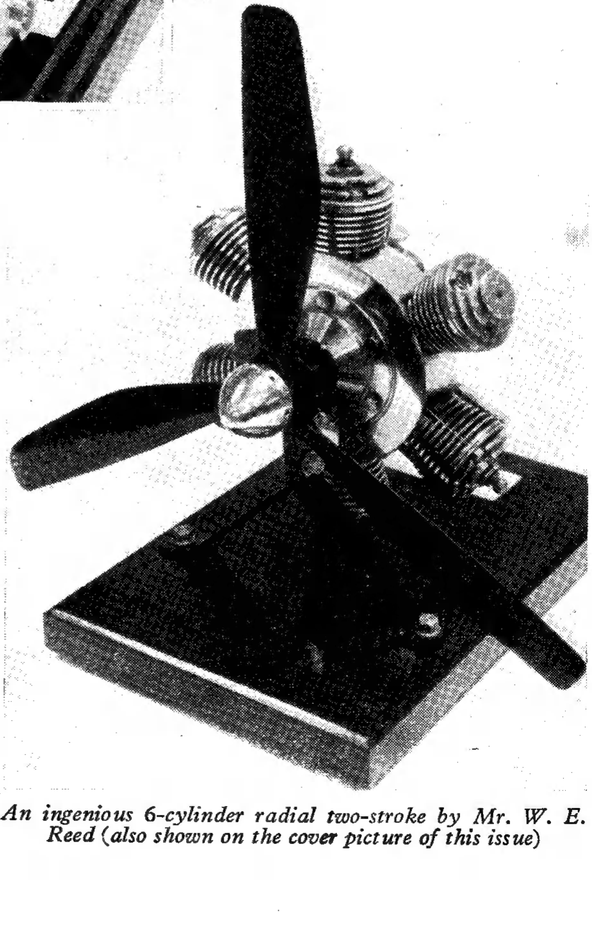
Mr. B. Stalham's 15 c.c. supercharged vee-twin engine

direct-coupled to the crankshaft. As in the previous example, the complete unit is mounted on a foundation plate which can be secured to the hull by four screws, and is therefore readily removable for access at any time.

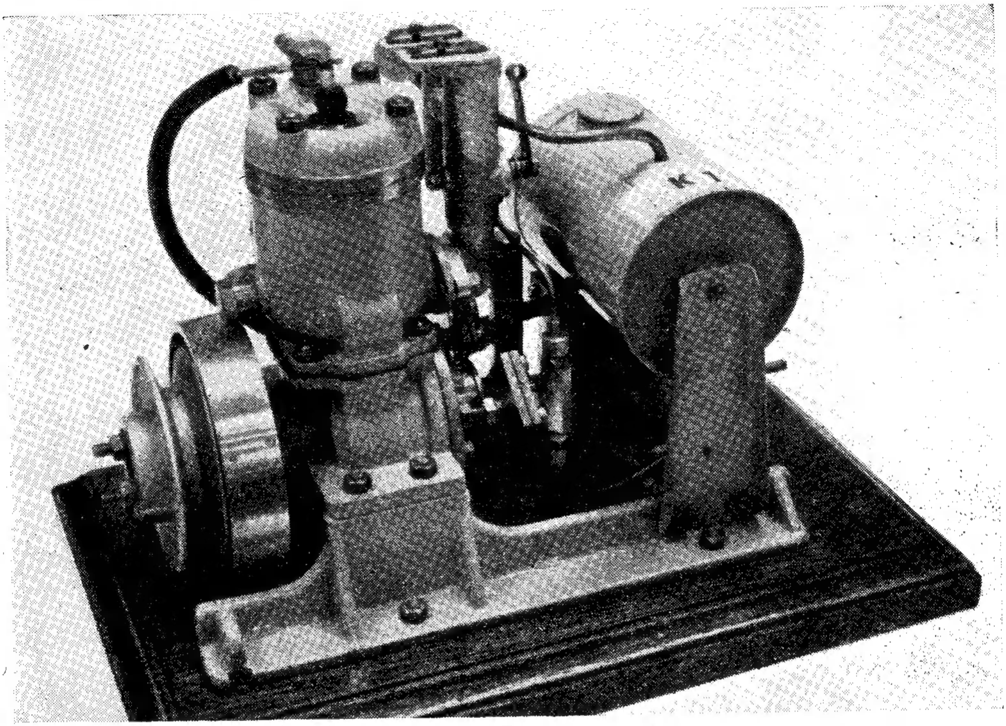
It is very unusual to see a model of an authentic "period" internal piston engine, and for this reason alone, the Tangye gas engine (1890-1900 period) is of outstanding interest, but in addition to this, its merits as an accurate scale model to a scale of 3 in. to 1 ft., and an example of sound workmanship, have also to be taken into consideration. The model is complete with working accessories, including the cooling water tank, gas bag and silencer, though the latter was not exhibited, due to a hitch in transport arrangements. It may be mentioned that the prototype of this engine was produced at a time when the gas engine was beginning to become a very serious competitor to the steam engine, as a means of producing power for small or moderate sized industrial installations, and this particular type was one of the most popular and

mechanical compensation by a barrel throttle is fitted. There are many problems in supercharging small i.c. engines, and up to the present there is insufficient information available to be able to forecast whether this particular venture is likely to be successful, but in any case, the model deserves the highest commendation as an example of good design allied with accurate and painstaking workmanship.

Mr. R. O. Porter, of Virginia Water, exhibits another example of a 2-stroke marine engine, similar in many respects to the one which was exhibited in the loan section at last year's "M.E." Exhibition, and which has worked successfully in a model boat for several years. In the present case, the basis of the unit is again a 30 c.c. 2-stroke built from Stuart Turner castings, but of a more up-to-date design, and the auxiliaries have been completely redesigned. Both the petrol feed and water circulation pumps are of the diaphragm type, and operated by variation of pressure in the crankcase. A compensated carburettor of original design is fitted, and ignition is by means of an M.I. miniature magneto



An ingenious 6-cylinder radial two-stroke by Mr. W. E. Reed (also shown on the cover picture of this issue)



The 30 c.c. marine power unit by Mr. R. O. Porter

successful of the many engines introduced about this period.

The popularity of the 15 c.c. "Seal" engine is proved by its regular appearance at nearly every model exhibition, and this year's "M.E." Exhibition is no exception to the rule. The one engine of this type in the competition section is by Mr. T. B. McKee of Westcliff-on-Sea, and is quite a well-made example, conforming to the original design in all essential particulars.

Other engines in the competition section include a 10 c.c. "Channel Islands Special" o.h.v. 4-stroke by Mr. T. W. Pedler, which is also a well-made and finished example of a standard design, and an ultra-miniature compression ignition engine of approximately 0.1 c.c. ($\frac{3}{16}$ in. bore by $\frac{1}{4}$ in. stroke) by Mr. A. G. Boulting of Richmond, who is well known as an exponent of this type of engine.

(To be continued)

"Operation Brunel"

A considerable amount of praise has been given to the Plymouth and District Society of Model and Experimental Engineers recently for its large scale model of the Plymouth railway system which was shown throughout the month of August at the "Plymouth Festival Exhibition."

The model, measuring 50 ft. by 12 ft., besides showing many of the well-known features in the City landscape, has two working main line tracks in 11-mm. gauge, one being the Western Region and the other being the Southern Region. The Western Region train is worked automatically, starting and reversing at the two termini and stopping at the intermediate local stations; while the Southern Region train is worked by a manual control. One particularly notable feature of the model is the famous Royal Albert Bridge built by Brunel who was the engineer of the Great Western Railway at the time.

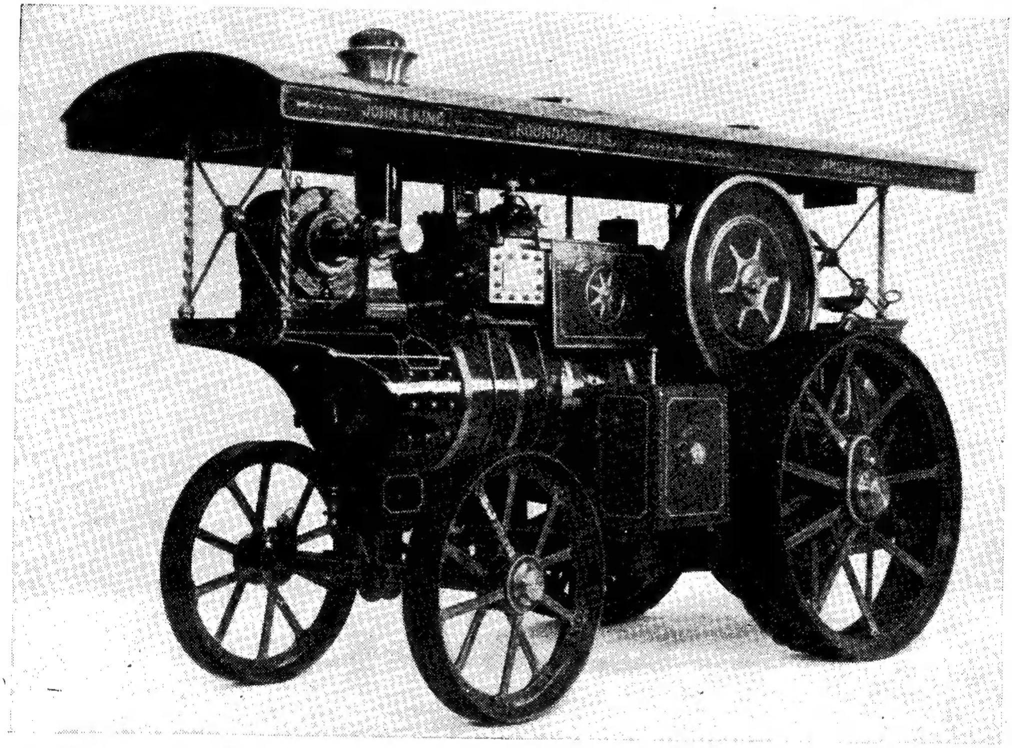
The trains themselves have been made by two members of the society, and although they are so small in order to keep within reasonable scale to the model, they stood up to the work remarkably well. The model abounds in fine model making and the dock areas are worthy of mention, having the usual dock buildings and some really first-class miniature shipping.

The whole model has taken only five months to construct and considering the immensity of the task, this is a remarkable achievement and in the words of a distinguished visitor, "one of which the society may justly be proud."

Traction and Portable Engines at the "M.E." Exhibition

by W. J. Hughes

IN this year's MODEL ENGINEER Exhibition there were entered for competition seven traction engines and four portables, but in each section one entry did not appear. In addition, there were six historical steam road vehicles on the loan stand, and the 2-in. scale traction engine run by the Sutton Club, giving rides in the somewhat restricted space of the dais.



Mr. King's fine model of a Wallis and Steevens Showman's Road Locomotive was deservedly awarded a Silver Medal. The detail work and finish were excellent.

The outstanding exhibit in these types was undoubtedly the very fine $1\frac{1}{2}$-in. scale Wallis and Steevens showman's road locomotive, built by Mr. J. E. King. I had a long chat with this gentleman, whose youthful appearance and outlook belied his 78 years. It is pleasant to note that he gives model engineering some of the credit for this, by the way!

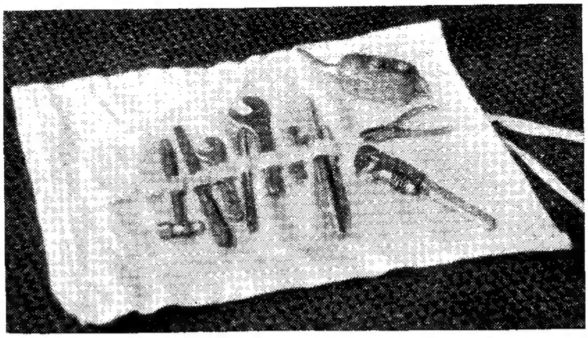
Mr. King knew nothing of traction engines before he started the model, but quite obviously he knows a good deal now! He is a retired engineer from the Royal Navy, and won a bronze medal for a locomotive at THE MODEL ENGINEER Exhibition in 1930. He now has a well-deserved silver medal to go with it. Perhaps a championship award another year, Mr. King?

That the engine is a true representation of the prototype is vouched for by a certificate signed by Mr. Arthur Wallis, chairman of the firm of Wallis and Steevens, and also by the fact that it was chosen as one of the exhibits to represent the firm at the Festival of Britain celebrations at Basingstoke. It was built from castings supplied by Summerscales of Cosham, and a drawing and brochure supplied by the firm.

The Wallis is a three-shaft engine—that is, there is only one intermediate shaft between the crankshaft and hind axle—and all the gearing is thus outside the hornplates, (which are the extended sides of the firebox). The change-speed gears for the three speeds are on the right-hand side of the engine, and the final drive on the left.

The three change-speed levers are interconnected by means of locking bars, as is usual, to ensure that not more than one gear can be put in mesh at one time.

In the model, the steel horn-plates are separate from the firebox sides, being bolted to them by means of extended stay-bolts. This, of course, is quite normal model practice. The boiler is of ordinary locomotive type, and contains fourteen ⅜-in. tubes. With regard to the details of the engine, however, the accompanying photographs will give a better idea than pages of words, I think.



A lovely little kit of tools made by Mr. King for the tool-box of his Wallis

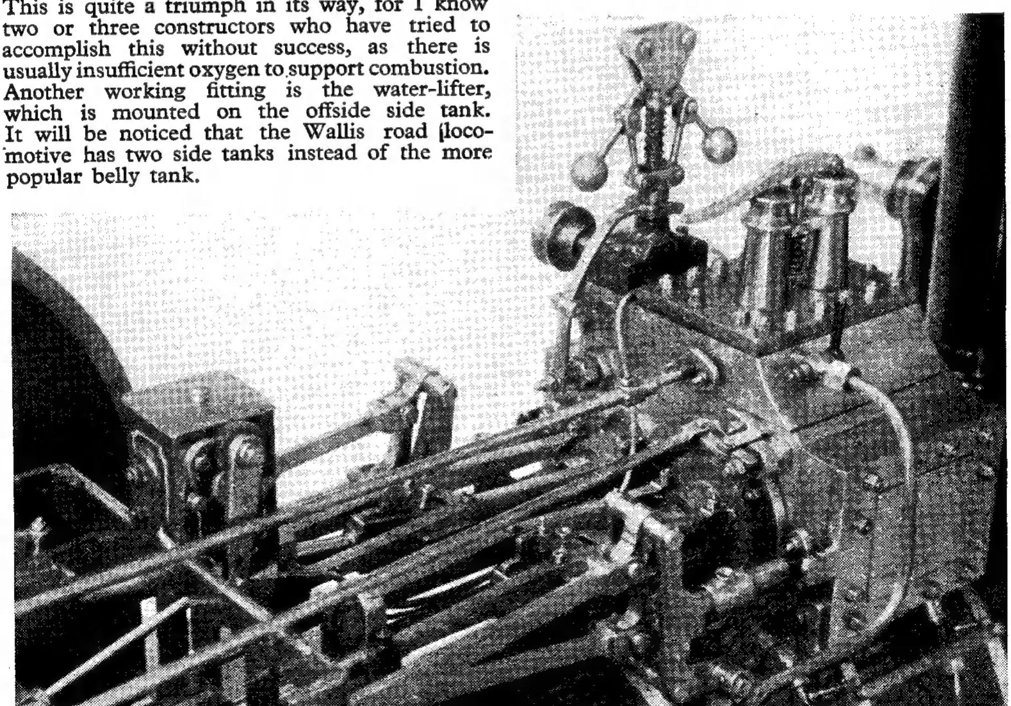
The paintwork was of good quality, though I am sure that Mr. King won't mind my suggesting that the lettering might have been more representational of that common to showman's engines.

The three oil lamps will light, by the way, and will keep burning (if handled carefully) after the containers are inserted in the lamp-bodies. This is quite a triumph in its way, for I know two or three constructors who have tried to accomplish this without success, as there is usually insufficient oxygen to support combustion. Another working fitting is the water-lifter, which is mounted on the offside side tank. It will be noticed that the Wallis road locomotive has two side tanks instead of the more popular belly tank.

Mr. King says that one of the most exacting jobs was working out the positions of the various steam passages in the compound cylinder block, and then drilling them; several pass at close quarters to each other or to the cylinder bores. Most of the fittings were fabricated, and some of the smaller castings were made by the builder, as were all the patterns. Mr. King even made his own pressure gauge, a task which is usually shirked by even the most rabid "made-everything-myself" merchant!

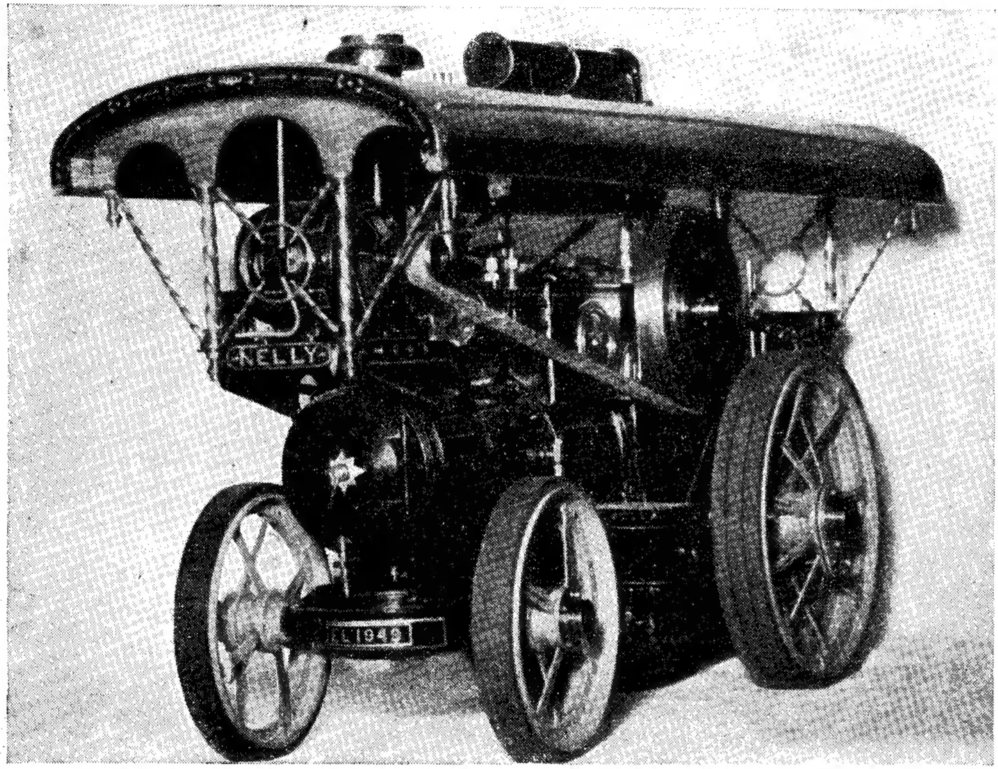
A 1¼ in. Scale Showman's Engine

I do not propose to devote so much space to E. Lowe's showman's engine, for this has been illustrated before in THE MODEL ENGINEER. (See issue dated January 11th, 1951, which gives four illustrations). It is an impressive and well-finished engine which suffers unfortunately



Close-up of some of the nicely-finished "works" of Mr. King's engine

from many defects inherent in the original design, for which, of course, Mr. Lowe is in no way responsible. To quote only one example, there are far too few spokes in the wheels for a road locomotive, or even a traction engine. (In this connection, it should be emphasised that you cannot take a traction engine, add showman's fittings, and then call it a showman's road locomotive. Road locomotives and traction engines were each designed for quite different functions, and possess many different individual characteristics).



E. Lowe's well-finished free-lance Showman's Engine was awarded a Bronze Medal. It is a "first attempt"

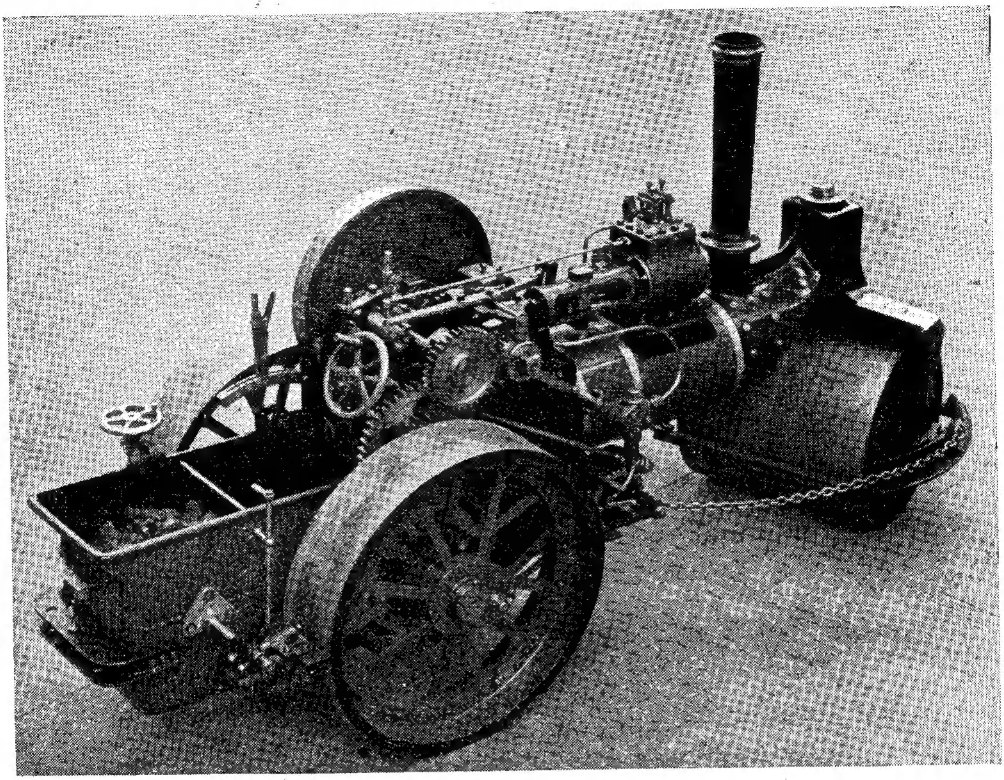
Mr. Lowe's engine also is a compound, with three shafts, and having seen it in action I know it is a *real* working model. For exhibition purposes, the dynamo can be used as a motor to drive the motion work, taking power from a transformer, and very nice she looks, rocking slightly on her wheel-base as she ticks over. When one bears in mind the fact that this is a first attempt, and that it has now won a bronze medal as well as high awards elsewhere, it seems a pretty safe bet to tip Mr. Lowe as a man to watch in future MODEL ENGINEER Exhibitions.

The Aveling Steam-Roller

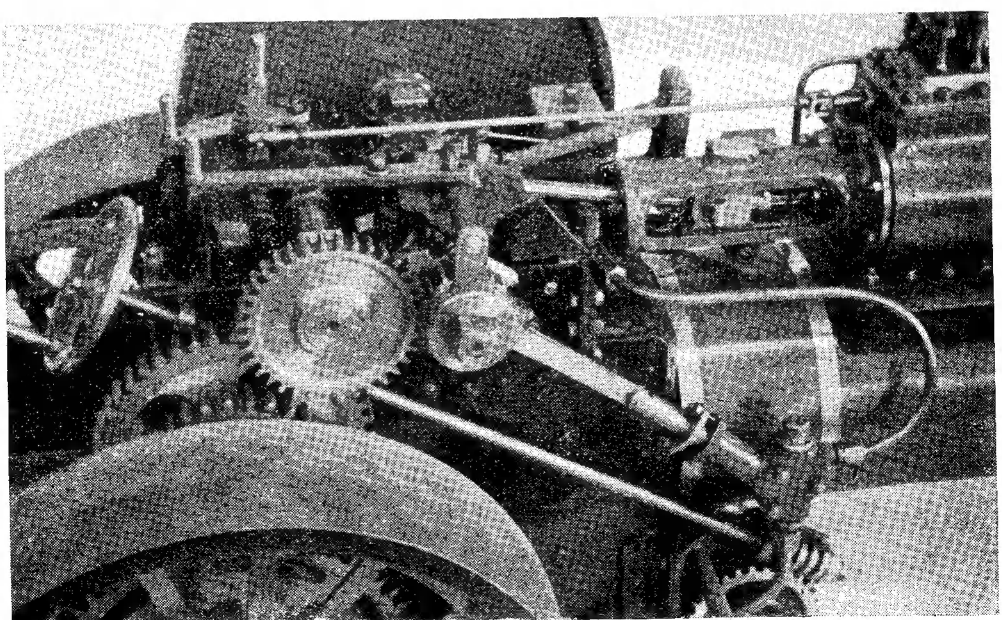
Another well-deserved "bronze" was won by R. G. Stone with his Aveling and Porter 10-ton steam-roller, also to $1\frac{1}{4}$ in. scale. As with the Wallis engine, this, too, was built from the drawings of the prototype, and a faithful representation of the original was the result—which, of course, need not necessarily follow. It still depends on the builder! Presumably the roller is not quite finished, for the lagging is not painted and no gear guards are fitted. It was noticeable, too, that the interconnecting bar between the two gear-levers is missing, and thus it is possible at present to mesh both change-speed pinions simultaneously with their respective spur-wheels. A situation which puts the gear-teeth in some peril! I would also suggest that Mr. Stone thins down the spokes of both the steering-wheel and the brake hand-wheel. The width is about right, but the section should be more oval. The remainder of the detail work is very well carried out, such components as the safety-valves and the brackets for the gear-levers and the brake shaft being most realistic.

The engine is a single-cylinder with piston-valve, and there are four shafts, that is, two intermediate shafts between crankshaft and hind axle. The fast speed gearing is between the hornplates, and the slow speed outside on the right. The final drive is also on the right-hand side. Altogether a very satisfying model of an all too rarely copied prototype.

(*To be continued*)



A well-detailed and true-to-life model of an Aveling and Porter Steam-roller, by A. G. Stone



Close-up of the engine of the steam-roller, showing the excellent finish

IN THE WORKSHOP

by "Duplex"

No. 98—Some Motor Car Repairs

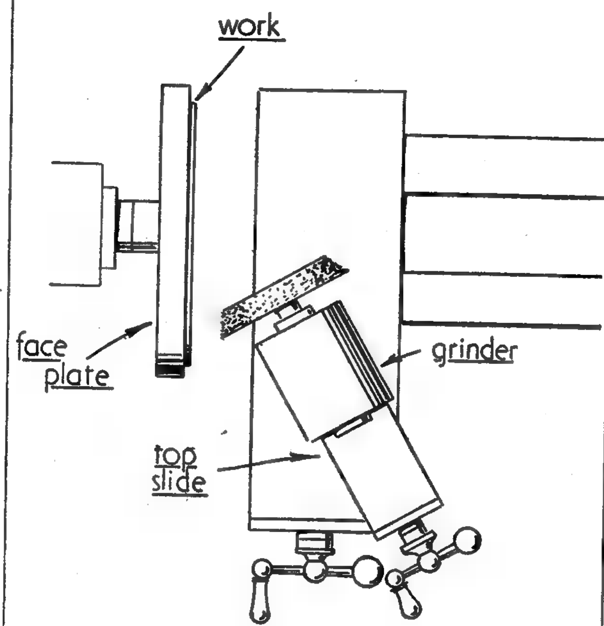


Fig. 1. Grinding a clutch plate in the lathe

NOW that the supply of new cars is so severely restricted, it has become more than ever important to keep old cars in good running order by carrying out repairs and fitting new parts.

It may, therefore, be helpful to some car users with workshop facilities to describe a few of the many repairs that have been carried out in a small workshop, where the resources are strictly limited. These notes were written in a locality abounding in old cars, but these vehicles continue to give reliable service, owing largely to the maintenance work done by their owners. Spare parts are, at the present time, both expensive and difficult to obtain; however, the small workshop can often make the simpler kinds of parts, or it may be found possible to adapt or recondition existing components.

Grinding a Clutch Plate

A good example of what can be accomplished with the modest equipment to be found in most small workshops, is the reconditioning of the clutch plate of an Alvis car. This vehicle is more than twenty years old, and recently clutch slip developed and gradually became worse. Unfortunately, the necessary overhaul had to be postponed and was not carried out until the clutch refused to engage. The complete clutch assembly was, therefore, removed from the car and dismantled.

To those readers who are accustomed to the modern design of car chassis, this will, no doubt, seem a formidable undertaking single-handed, but in the present instance the engine, clutch, gearbox, and and back axle are separate units, and this form of construction, quite commonly found in old cars not of the mass-produced type, allows any unit to be removed independently in a comparatively short time. The clutch assembly is, perhaps, the easiest to deal with, for in the Alvis this can be withdrawn after disconnecting the primary shaft and removing the six bolts holding the body of the clutch to the rim of the flywheel — an operation when carried out single-handed occupying less than half-an-hour. The construction of the Alvis clutch, like that in many old cars, is very simple and consists of a single steel plate, of large diameter, mounted on a shaft that is carried in a sleeve bearing in the clutch body itself. The clutch linings are riveted to the inside of the body as well as to the pressure plate, and the clutch plate is located between these two friction surfaces. On dismantling the clutch, it was at once seen that the friction linings were quite worn out, but these were easily renewed by fitting spare discs. The clutch plate was, however, in very bad condition, as both contact surfaces were scored and rough. Machining the plate with a carbide-tipped tool was considered, but this was rejected, as the finish obtained was not good enough, and it was, therefore, decided to improvise a set-up for grinding the plate to a high surface finish.

An old electric grinder, fitted with a suitable wheel of 4 in. diameter, was mounted on the lathe top-slide by gripping the base of the motor under the toolpost clamp-plate. As shown in Fig. 1, the top-slide was swung over so as to

provide [illegible] finer depthing feed for the grinding wheel. The clutch plate was next removed from its shaft and, after being bolted to the lathe faceplate, was set to run truly with the aid of the dial test indicator.

When the lathe had been set running at low speed, the grinder was started and was fed across the face of the work by means of the cross-slide feed. The grinding was continued, by taking cuts of [illegible] quarter-of-a-thousandth of an inch, until [illegible] smooth finish had been formed all over the working surface of the plate.

The plate was then reversed and the other side was ground in the same way. The clutch, with its new linings and reground plate, was next reassembled and then replaced in the chassis.

On carrying out [illegible] road test, the clutch engagement was now found to be quite smooth and there was no sign of slip under running conditions.

Stopping Water Leaks Round Cylinder-head Nuts

An annoying trouble often encountered in old cars is water leakage at the cylinder-head securing nuts. This is a tiresome fault at any time, but when it occurs in an engine with overhead valves the defect is even more serious, for the water will then find its way into the engine sump through the passages designed to return the lubricating oil from the valve-gear back to the base.

A serious water leak of this kind was found when the engine started to discharge frothy oil from the crankcase breather, and inspection of the dipstick showed that water was mixed with the lubricating oil. On removing the valve-cover, water was seen to be leaking freely round one of the cylinder-head nuts, and clearly this was the cause of the trouble. No doubt, the leak was due, in the first instance, to a faulty gasket, but [illegible] a replacement could not be obtained at the time, an effective, temporary repair was made in the way illustrated in Fig. 2.

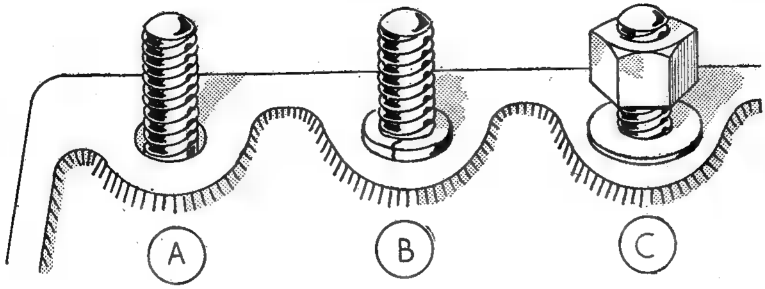


Fig. 2. Method of sealing a water leak round [illegible] cylinder-head nut

As will be seen in Fig. 2A, there is normally an annular clearance between the stud and the stud hole in the cylinder-head, and it is, of course, through this gap that the water escapes. It might be thought that the nut itself would effectively seal the leak, but in practice this is not so and the water usually finds its way along the threads in the nut.

A cure can, however, be effected by using [illegible] suitable packing between the stud and the cylinder-head. As will be seen in Fig. 2B, this packing consists of a ring of lead wire or, instead, [illegible] length of resin-cored soldering wire can be used.

The packing material is wound neatly round the stud and is then pressed into place by lightly tightening the head-nut.

A well-fitting steel washer is next slipped [illegible] to the stud, and the nut is fully tightened to squeeze the packing material well into the screw threads, as represented in Fig. 3.

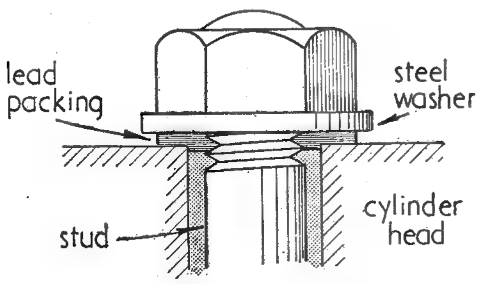


Fig. 3. The finished water seal

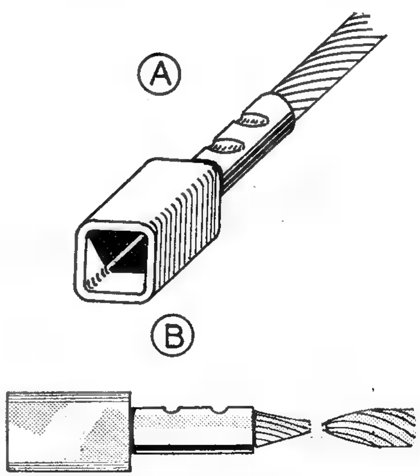


Fig. 4. (A) the speedometer cable fixed in the coupling by crimping; (B) the usual form of cable breakage

Repairing Speedometer Cables

It is not uncommon in old cars to find the speedometer inner cable broken, usually at either the drive or the instrument end. When making up new drive units, the cable is secured in place by crimping the adapter or coupling in

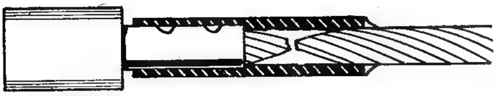


Fig. 5. Fitting a sleeve to repair the cable

the way shown in Fig. 4A. The break generally takes the form shown in Fig. 4B, and this leaves a short, frayed end that can be removed from the coupling only with great difficulty.

The broken end is, however, best left in place in order to maintain the original length of the cable when the two broken parts are butted together. To form the new joint, a steel sleeve is made to fit over both the cable and the adapter.

As shown in Fig. 5, this sleeve has two different internal diameters made to fit closely on the two parts, so that the ends of the cable are securely held in alignment during the sweating operation. Before the acutal soldering is undertaken, however, the parts must be carefully freed from grease, but this is apt to be troublesome, as the strands of the wire cable tend to retain the old

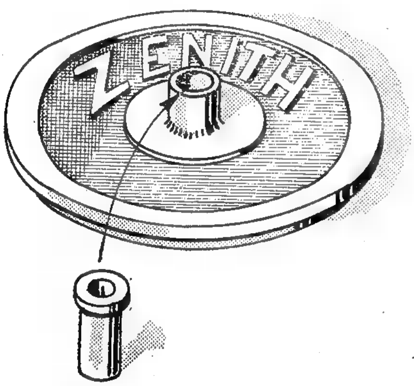


Fig. 6. Fitting a small bush to the carburettor-float chamber cover

oil. Nevertheless, a thorough soaking in petrol or carbon tetrachloride, followed by wire-brushing, should be effective. The sweating is best carried out by using one of the solder paints, as these are made up with a highly-active flux, and, in order to avoid over-heating the work, it is, perhaps, safest to employ an ordinary spirit lamp.

It should be borne in mind that nothing is gained by making the walls of the sleeve unnecessarily thick ; in fact, a thin-walled sleeve is preferable, as long as it has sufficient strength to transmit the drive.

Bushing a Carburettor-Float Chamber Cover

After several years' use, the guide for the float needle in the cover of the float chamber becomes worn, with the result that the needle tends to stick and the carburettor then floods. This flooding is most noticeable if the petrol is normally turned off when the car is idle, for the needle then sticks in the raised position and, when the petrol is next turned on, there is great wastage as the fuel overflows from the float chamber vent. As will be seen in Fig. 6, a lug

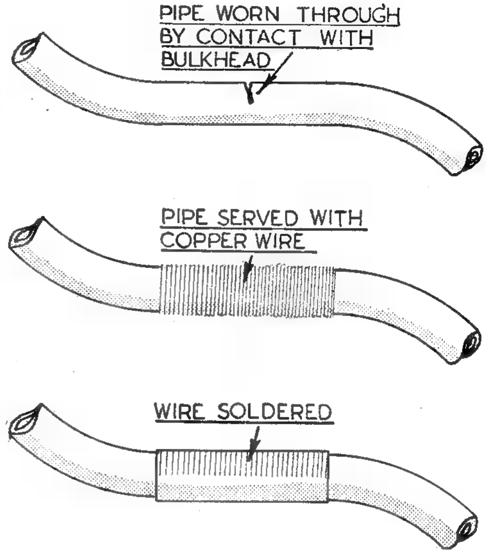


Fig. 7. Method of repairing a damaged oil pipe

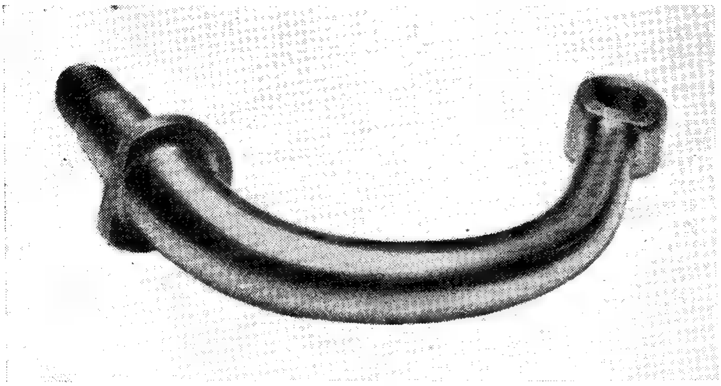
is cast on the top of the cover to serve as a guide for the needle, but there is here not enough metal to allow a substantial bush to be fitted. However, if a liner, having walls some fifty-thousandths of an inch in thickness, is fitted, a satisfactory repair can be made. For this purpose, the cover is gripped by its register in the four-jaw chuck, and, after a drill has been put through, the hole is finished to size with a small boring tool. The bush is best made from a piece of bronze rod, turned on its outer surface to give a light interference fit in the cover, and the bore must, of course, be drilled concentrically so that the needle will be accurately guided.

To allow the needle to move freely, a working clearance of approximately two-thousandths of an inch is given when drilling the guide hole in the bush, for the bush will contract slightly on being pressed into place.

Repairing a Defective Oil Pipe

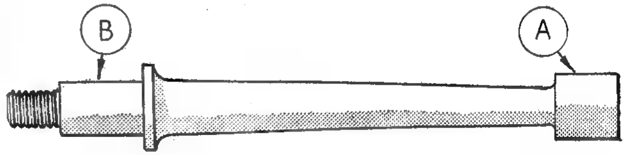
The pipe connecting the oil pressure gauge to the union on the engine crankcase usually passes through a metal bulk-head behind the fascia board ; a rubber bush is then fitted to the bulk-head to carry the pipe and to prevent its being chafed or damaged by vibration.

In time, this bush may deteriorate and the



Left—
Fig. 8. *The finished steering-arm after bending*

Below—
Fig. 9. *The machined steering-arm*



pipe, by rubbing against the sharp edge of the bulk-head, may be worn through.

When this happens, a new pipe need not be fitted, for the damage can be repaired by first removing the pipe and then serving it with thin copper wire. When this wire is finally sweated in place, not only will the damage be made good, but the pipe itself will be strengthened and given additional protection.

The method of repair illustrated in Fig. 7 is recommended in preference to cutting the pipe and sweating the two ends into a specially made sleeve, for by adopting the former course the run of the pipe will not be upset.

Making ■ New Steering-Arm

Recently the steering arm of an Austin Seven, kept in almost daily use, broke as the car was being driven out of the garage. Examination showed that, to keep the car on the road, the broken arm could be repaired by welding; nevertheless, for permanent use it was decided to make ■ new steering-arm from a side-shaft discarded from ■ Hillman Minx.

Although the original steering-arm was ■■ L-shaped forging, it was thought best to bend the new part, after machining, in an even curve as illustrated in Fig. 8, so that the eye at the end of the arm would line up correctly with the spigot turned to fit into the stub-axle knuckle. The old arm was roughly rectangular in section and tapered towards the eye, but in view of the recent breakage, it seemed advisable to give the new part a little extra strength. Accordingly, the arm was made circular in cross-section and with its smallest diameter equal to the largest diameter of the old part. There was no difficulty in machining the new arm, and the part needed only to be turned taper and then threaded before being bent

(*Continued on page* 389)

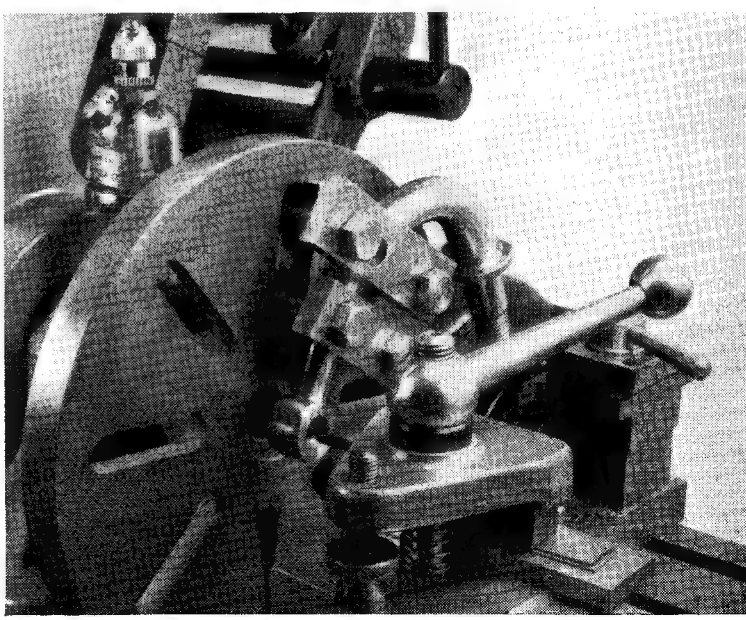


Fig. 10. *Set-up for machining the steering-arm eye*

WORKSHOP EQUIPMENT AT THE EXHIBITION

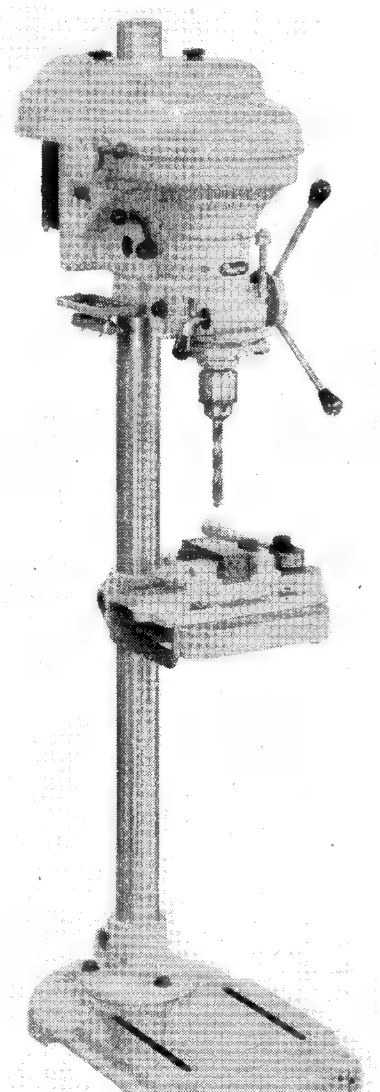
IT is always interesting to examine the new tools shown at the Exhibition and to try and assess both their quality and the part they may be expected to play in lightening the work of the owner of a small workshop.

However, it should always be borne in mind that a well-made tool of sound basic design can generally be adapted to meet special or unusual requirements, whereas a piece of equipment that is ill-conceived or poorly made will rarely give even temporary satisfaction.

In these days of shortages and high labour costs, both hand tools and machines are necessarily expensive as compared with those of a generation ago, but the old saying that "it pays in the long run to buy the best" is as true now as it ever was.

Nevertheless, there have been times when a piece of equipment, such as a machine vice, has had to be purchased as being of the right size and design for the purpose in hand, irrespective of the quality of the workmanship; but to obtain a useful tool some of the working parts have had to be added to the contents of the scrap box, and the base casting made accurate by re-machining and hand-scraping—an expensive and time-wasting way, no doubt, but one that gives ultimate satisfaction.

A visit to Messrs. Buck & Ryan's stand did, however, do much to dispel these rather gloomy forebodings, for this firm, who as far as we know have never missed a MODEL ENGINEER Exhibition, had a representative display of both hand tools and machine equipment eminently suitable for use in the small workshop.



The "Pacera" 10-speed, floor model drilling machine

When attempting to assess the quality of a machine, the name of the maker must necessarily carry great weight, for it may be taken for granted that a manufacturer possessed of a good name will never risk sacrificing his reputation by putting a bad tool on the market—a single product of exceptional quality may be sufficient to establish a reputation, but an unfortunate venture may take a long time to live down. It may also be assumed that a manufacturer of repute is backed by the resources of a well-equipped factory as well as the services of skilled workmen; these assets, together with a system of rigid inspection, make for the economical production of high class goods at a price beyond the reach of less fortunate competitors.

Precision Quality

In the past, the term precision, when applied to a machine tool, had a very definite meaning although it could not be easily defined, but latterly owing to misuse of the word, this term is often almost meaningless when found in catalogues and may in no way indicate the true quality or capabilities of the machine. There was a time when, for example, a lathe described as a precision tool was not only of massive construction, in order to avoid possible distortion of the bed and working parts, but both the mandrel and its bearings were hardened, ground, and finally lapped to a fine finish. Again, it was regarded as an essential part of the design that the tailstock barrel should be fully supported throughout its range of travel; the machine slides, too, were of extra length and, even when closely adjusted, could be moved by spinning the feed handle with the

finger. These are only a few of the features found in a true precision lathe. As a result of correct design and superlative workmanship, a precision lathe was capable of machining work with very great accuracy and, as the rate of wear in the working parts was hardly perceptible, this accuracy of working was maintained indefinitely. Makers of lathes such as these did not hesitate to supply test charts showing, for example that the inaccuracies in the full length of the lathe bed did not amount to more than a few ten-thousandths of an inch.

Needless to say, the headstock alone of a true precision lathe would cost more than a whole lathe of the ordinary kind. When, therefore, considering the purchase of a precision tool, it is advisable to make sure that the machine is designed in accordance with accepted practice, and that the maker's test chart shows that any inaccuracy present is extremely small, as compared with an ordinary lathe of good quality and recognised accuracy.

Two Drilling Machines

Within the past few years, following American practice, many drilling machines have been introduced fitted with a self-contained motor drive. Messrs. Buck & Ryan exhibited the "Pacera" drilling machine, model M.F.4., with ten spindle speeds obtained by using a V-belt drive in connection with 5-step cone pulleys, and supplemented by a two-speed backgear engaged by working a lever mounted on the outside of the machine.

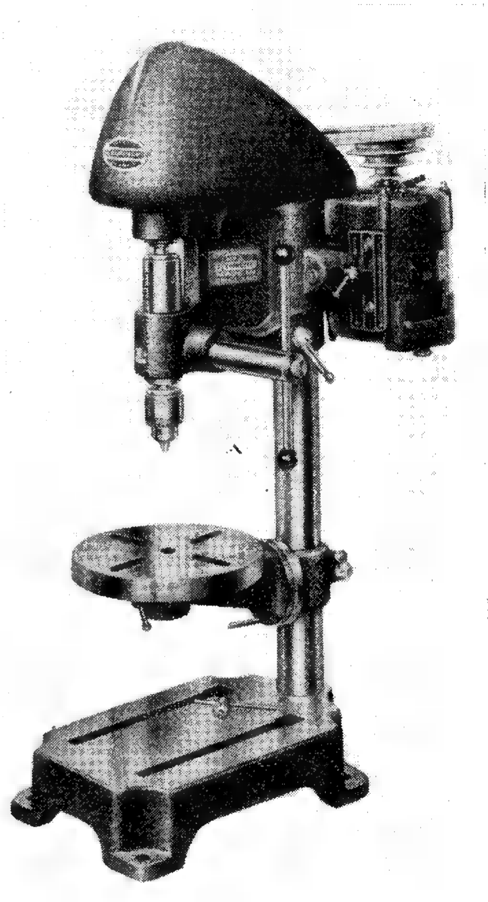
On the other hand, altering the spindle speed by shifting the V-belt would seem, at first sight, to be a rather more formidable undertaking, necessitating removal of the belt cover, followed by sliding the motor forward to slack the belt and so enable it to be shifted on the pulleys.

Easier manipulation would no doubt follow if the cover were raised by a lever and the belt tension controlled by means of a lever and toggle mechanism for moving the motor. This would, of course, be a convenience in the small workshop where the drilling speed may have to be constantly altered when machining a single piece of work; whereas, in commercial practice, the machine may be required to run at a constant speed for long periods when machining a large number of similar parts. The wide speed range of 80 r.p.m. to 4,000 r.p.m. is of great value to the amateur and enables holes to be drilled up to $\frac{7}{8}$ in. in diameter in mild-steel and, in addition, tapping operations can be carried out and the tap backed out by using the reversing switch conveniently placed at the side of the machine.

The makers' specification shows that the design is straightforward and comprehensive and, at the same time, many detail refinements are included, comprising: sensitive adjustment of the tension of the return spring; dynamically balanced pulleys, column tool tray; and Tecalemit gun lubrication with oil-retaining seals to all bearings.

The Champion range of drilling machines has been supplemented by the new No. 3 model of $\frac{1}{2}$ in. capacity. This machine is single-geared and the drive is by means of a self-contained electric motor driving the 4-step cone pulleys with a V-belt. The motor base, carried on pintles sliding in the machine head, is moved backwards or forwards for shifting the belt and adjusting its tension.

By reason of the single-stage drive, the lowest speed obtainable is given as 460 r.p.m.; this might be found rather high for the great variety of countersinking and spot-facing operations carried out in small workshops, moreover, drilling hard, cast-iron with a $\frac{1}{2}$ in. diameter



The Champion No. 3 drilling machine of $\frac{1}{2}$ in. capacity

carbon-steel drill might give rise to difficulties at this spindle speed. Not all workers will appreciate the crackle finish, for, although this has a very pleasing appearance on optical work, these rough surfaces are not always easy to clean when bespattered with oil.

The Ajax Milling Machine

This horizontal milling machine, of moderate capacity, has a table 16 in. × $4\frac{1}{2}$ in. and is supplied with a variety of ranges of spindle speeds; the lowest being 65 r.p.m. to 290 r.p.m., and the

highest 150 r.p.m. to 720 r.p.m. The driving motor, of $\frac{1}{2}$ h.p. to $\frac{3}{4}$ h.p., is housed in the pedestal of the machine, and the drive is taken by V-belt to a countershaft and thence to the machine spindle. To change the spindle speed, the large sheet-iron cover at the back of the machine is removed by undoing two nuts, and the belts can then be sprung into the appropriate grooves in the two coned pulleys. In the specification issued, the manufacturers do not give particulars or drawings of the mounting of the machine spindle, so these details cannot be described without first dismantling the machine. The longitudinal traverse of the table is effected either by using the feed screw to obtain a fine feed, or the lever and rack mechanism can be employed for rapid traversing. Adjustable stops are fitted for controlling the traversing movements of the table. A comprehensive range of extra fittings is listed, including a machine vice, a dividing head, a coolant system, and an end-milling attachment.

The cross-slide alone is furnished with a graduated index, but a similar fitting on the table slide would be a useful adjunct. A good point noted was the robust design of the gib-pieces fitted to the machine slides.

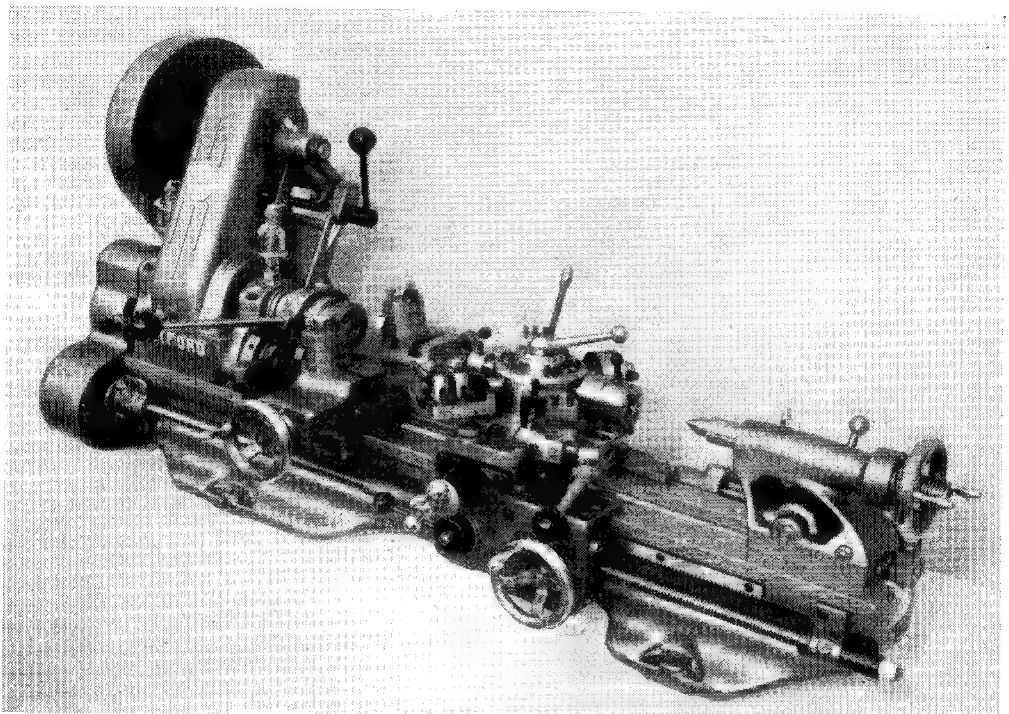
Small Tools

Among the smaller tools seen on Messrs. Buck & Ryan's stand was the highly-finished "Allbright" machine vice having a holding capacity of $1\frac{5}{8}$ in. and a jaw depth of 1 in. Some small pliers and end-nips of French manufacture were also noted because of their superior finish, but judged by former standards these were somewhat expensive.

The Myford Stand

It is always an interesting and pleasurable experience to visit the Myford stand, if only to witness the friendly and helpful manner in which the directors, in person, deal with the throng of enquirers seeking information and advice. As to the machines themselves, that is to say the "ML7" lathe and the "ML8" wood-working lathe, improvements and additions are constantly being made, and we noted that Tufnol pinions can now be supplied for the tumbler gear; this is an undoubted improvement in making the wheels almost silent in operation. Some time ago, Mazae pinions in the backgear were replaced by cast-iron gear wheels; this has not only increased the strength and wearing qualities of these parts, but the new gears are not liable to become damaged by stray metal chips. Stove enamelling is now largely used instead of spray painting, and a much more durable form of finish is thus obtained. Lubrication nipples, supplied by means of a force-feed gun, are now fitted at all important points so as to ensure proper lubrication of closely-fitted bearings.

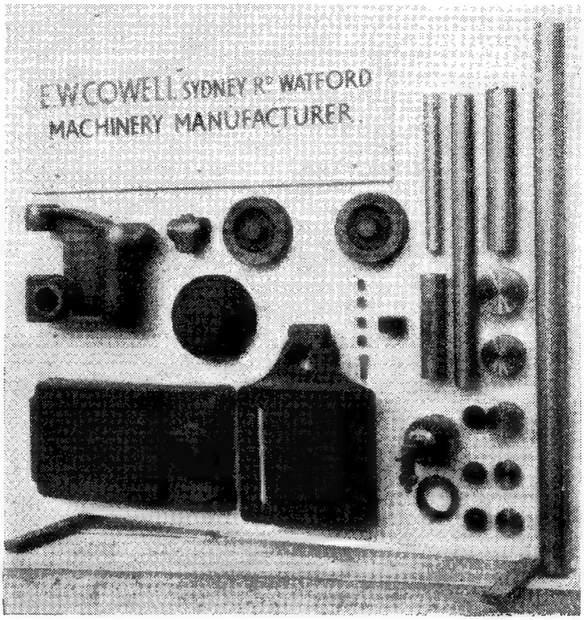
A bench lathe was exhibited fully equipped to undertake repetition work, for lathes of this make are now largely used commercially for



The Myford ML7 Lathe equipped for repetition work

machining batches of small parts to fine limits of accuracy. Here, the mandrel collets are opened and closed by ■ hand lever so that the workpieces can be changed while the lathe is running.

An auxiliary cut-off slide is fitted on the lathe bed, and the six-station saddle turret is rotated and accurately located by means of the usual hand lever. A very pleasing type of finish, which, we understand, can be supplied to special order, is that known as metallic lustre finish of a green-grey shade. The wood turning lathe was seen in operation with an expert turner making table legs and demonstrating the sawing and grooving capabilities of the machine.



Set of machined castings and materials for constructing the ⅜ in. Cowell Drilling machine

Kennion Bros. Ltd.

The small tools and threading equipment manufactured by this firm are well known to model locomotive builders, and it is satisfactory to learn that a great variety of steel strip, bars and rod can still be supplied. In fact, we were told that steel flats are available in no less than ■ hundred and seven different sizes, ranging from $\frac{1}{16}$ in. × ¼ in. to ½ in. × 3 in. In addition to this material, there are ground mild-steel and silver-steel rods, as well as free-cutting stainless-steel in many sizes. Supplies of brass and bronze are another matter as, owing to the present restrictions, may only be used for certain specified purposes which, unfortunately, do not include model making.

The Sample Display Stand

Here, Messrs. Cowell showed sets of machined castings and materials for building ■ 6 in. stroke, hand-operated shaping machine, and also for constructing their ⅜ in. capacity drilling machine. Examination of both the finished machines and the sets of parts showed that the workmanship was of good quality throughout and that the design is quite straightforward, without unnecessary complications. As the machining and fitting remaining to be done can be carried out in the small workshop with the aid of ■ 3½ in. lathe and ■ small drilling machine, ■ worker with quite modest equipment and experience can build for himself ■ useful hand shaper or drilling machine at only ■ fraction of the cost of a new machine.

Quite apart from the saving of expense, there is always great satisfaction in making one's own tools and knowing that the finish and fitting are as one would like. For holding work in either of these machines, ■ useful type of machine vice was exhibited both in the finished state and as ■ set of machined castings.

(*To be continued*)

In the Workshop

(*Continued from page* 385)

to shape when brought to ■ red heat. The arm was turned to the form shown in Fig. 9 by mounting the work between centres, but the head, A, was not cross-bored until after the part had been bent to shape.

After the arm had been raised to a red-heat, the spigot, B, was gripped in the vice, so that a length of tubing could be slipped over the other end to afford additional leverage for bending the work to shape.

The head of the arm was then marked-out and centre-drilled in the drilling machine. Next, as shown in Fig. 10, the arm was clamped to the lathe faceplate, and the centre formed in the head was set to run truly with the aid of the wobbler. After ■ pilot drill, followed by a larger drill, had been put through the work, the bore was faced and machined to the finished diameter with ■ small boring tool.

Finally, the new arm was polished and well greased, and the steering gear was reassembled without difficulty. There seems to be no reason why this replacement should not do permanent duty, as it should be strong enough to withstand any strain likely to be imposed in ordinary running.

BRUSH PAINTING WITH CELLULOSE

by W. E. Atkinson

I WONDER how many model engineers know the advantages of using cellulose paint, in place of oil paint, for painting models. Cellulose paint is tough and flexible; it is completely unaffected by oils or petrol, and will take ■ very high polish when necessary. Best of all, it is very quick drying, so that a model can be painted and dry in a morning's work.

The idea that cellulose paint can only be sprayed on to a surface is wrong, and readers will have success in brush working it, if the following instructions are carried out.

Half-pint tins of what is known as brushing cellulose can be obtained from Halfords and most motor accessory factors, the price being a little more than top quality oil enamel. Obtain a tin of each colour that will be required, together with a tin of what is known as primer and make sure that you get cellulose enamel. Undercoatings can be obtained, but are not necessary for our work. Although this material is known as brushing cellulose, it is still much too quick-drying for painting the intricate surfaces of a model, and must be retarded still further.

Armed with a small face cream jar and a quart bottle, pay a visit to any big garage, where they have a spraying shop for the cellulose refinishing of cars, get friendly with the painter or foreman and ask him to sell you a quart of ordinary cellulose thinners and to fill your little jar with what is known in the trade as retarders; this is simply commercial caster oil, a sticky amber-coloured fluid. Cellulose thinners can be bought in small tins with the enamel, but it is an expensive way of buying it, because quite a lot is used for thinning the enamel, cleaning brushes and cleaning down parts before painting. The trade price of thinners is about 20s. per gallon. This is all that is necessary to convert the cellulose into a medium suitable for painting. A word of warning—cellulose paints and thinners are highly inflammable, much more so than oil paints and turps, so take care. Starting with the tin of primer, add about a tablespoon of thinners, and with a stirring stick made of $\frac{1}{4}$ in. metal rod, dip to a depth of about $\frac{1}{2}$ in. into the retarders, lift it out, twizzle it round like a spoonful of treacle and transfer it to the tin of primer. Stir and keep on stirring, for at least ten minutes. A test can now be made. Paint the surface of a small piece of clean metal and two or three minutes later run an empty brush over the surface when the brush marks should readily even out again. If the surface has become tacky, add a tiny drop more retarders, stir in thoroughly, and test again. Do be careful with the retarders, a little bit too much and the paint will not dry at all. The surface under test should be dust dry in 30 min., and hard in an hour and a half. Having successfully treated the tin of primer, do the same with the colours.

The best brushes to use for applying the paint are what painters call fitches, but any small good quality brush with fairly stiff coarse bristles will do. Always keep a pot of thinners by and put the brush straight into it when you have finished painting a section. To carry on, lift the brush out and squeeze the thinners out with a piece of rag. The brush then will always be clean and flexible.

The method of applying the paint is the reverse of the recommended procedure for oil paints, where one takes a little on the brush and rubs well out. With cellulose one takes a good brush load and spreads over the surface with as few brush strokes as possible, remember when going round the spokes of a fly-wheel that you must catch up with your starting point within two minutes or so, otherwise the join will show, and having completed the section do not go back and touch up any spots that you may have missed, it is quite fatal; let the surface harden and then go over it again. Even when a cellulose painted surface is years old a new coat of cellulose applied on top quickly penetrates and softens the undercoat, so brush work must be kept to a minimum.

Prepare the work by washing the surface with thinners, if it is very greasy and dirty it can be first washed in paraffin; but always finish off with thinners. The paint should be maintained ■ little more fluid than it is when you buy it, by adding thinners; but do not add any more retarders after the initial dose and always stir well. If cellulose paint is left to stand, the pigment gradually settles to the bottom; but no skin forms as with oil paints, so there is never any need to strain. Coat the parts to be painted with the primer. Usually by the time you have finished the last part, the first one is ready for the enamel, so the process is more or less continuous until the whole job is done.

Where a high polish is required, the under surface must be smooth. The paint is applied in the same way, primer and then enamel. A tin of "Simonize Kleener" and a lot of elbow-grease will eventually produce ■ brilliant surface, which can then be preserved with a little wax polish.

For filling up a rough surface, such as the surface of an awkwardly shaped casting on which a smooth painted finish is required, obtain from our friend the spray shop foreman, ■ small quantity of what is known as knife stopper, and a sheet of medium grit "wet or dry" paper. The knife stopper is simply ■ cellulose filler of putty consistency and is spread thinly over the surface of the casting, so that it fills in the roughness, and allowed to harden. The "wet or dry" paper is an emery paper, that is used with water. Cut off a small piece and then rub over the surface of the casting, using plenty of water to wash off the surface as the work proceeds. When the surface is dead smooth wipe it dry.

The cellulose enamel can then be applied. With ■ little experience in using cellulose, oil paints go to the back of the paint shelf, and stay there.

*A Chiming Gear

for the Battery-Driven Electric Clock

by C. R. Jones

THE drawing of the relationship of chime drum, and hammers, shows the support and the various parts including the hammer springs, which are four very light tension springs threaded on to the hammer tails and resting in the angular part.

The other ends of springs being supported by the spring anchor which needs no description and is clearly shown on the drawing and photograph No. 5.

Release Magnet

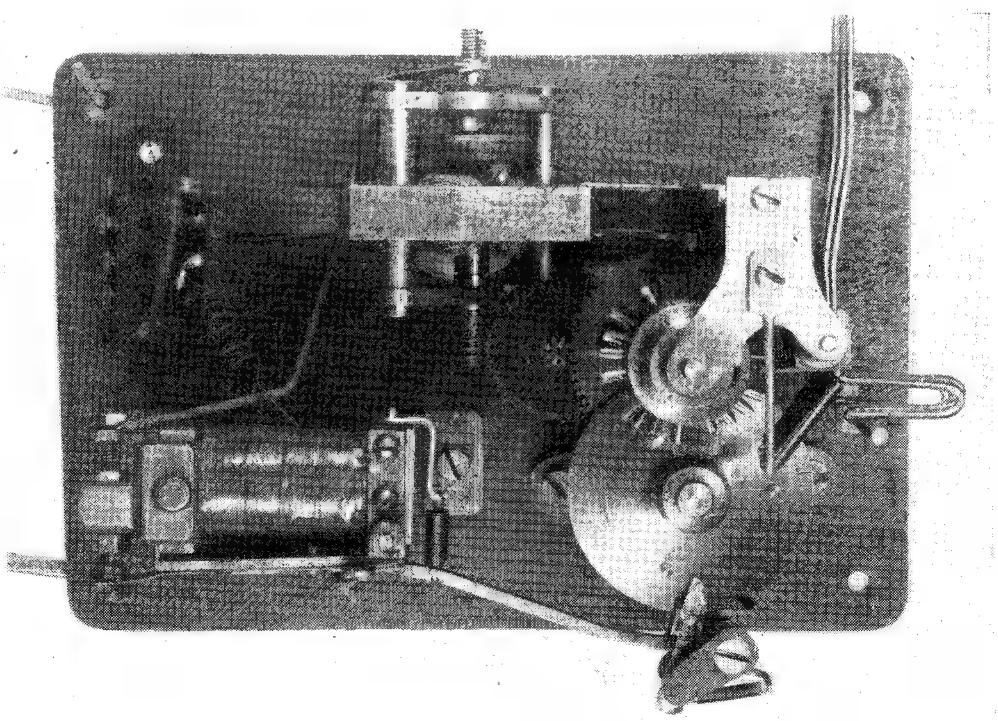
The magnet core was made from mild-steel to the sizes shown on the drawing, the ends being pressed on to the core after the parts had been well softened. The armature was made from $\frac{1}{16}$ in. thick material (also softened), the ears for the hinge portion being turned over at right-angles, and drilled to accommodate the short studs which were drilled and tapped into the right-hand end of the magnet core, 3/32-in. Whitworth thread being used, a plain portion being left for the armature to work on, the ends being slotted for a screwdriver for tightening.

A control lever was made as shown on the drawing, and had a small slot at the right-hand end, into which was inserted a small piece of hacksaw blade (to the sizes shown) and this was silver-soldered into position. The control lever was also silver-soldered into position on to the armature, as shown.

I see no reason why soft-soldering could not be used, for this and most of the other positions where silver-solder was used.

A contact spring was also fitted to the armature, as shown, and in this case was 0.020 in. thick, a contact being soldered on to one end, the other end being punched with two holes and secured to the armature by two No. 8 B.A. set-screws.

*Continued from page 362 "M.E.," September 13, 1951.



Photograph No. 6. Plan view of chiming gear

The bracket for the fixed contact was made to the sizes shown, from [redacted] short piece of $\frac{5}{16}$ in. square brass rod, which was silver-soldered to [redacted] right-angle bracket made from brass about 1/32 in. thick. This was secured to the left-hand end of magnet by means of [redacted] No. [redacted] B.A. set-screw, [redacted] piece of thin fibre being placed between the bracket and the magnet core end, also [redacted] small bush being fitted to the hole in the top of the bracket, [redacted] fibre washer being placed on top and under the screw-head to complete the insulation of the bracket from the magnet.

A suitable adjustable contact was fitted to the hole shown, and tapped to receive it.

When assembled, the two contacts were, of course, in line, and adjusted to make contact when the hinged armature was pressed up to the pole-pieces.

It will be seen by the photographs, that the release magnet is mounted on two angle brackets to bring it up to the correct height to ensure that the hacksaw insert in the end of the control lever engages centrally in the slots in the control disc.

These brackets *must* be of brass or some other non-magnetic material.

The magnet core [redacted] then insulated with thin brown paper, and [redacted] wound with No. 26 gauge silk covered wire to $\frac{3}{4}$ in. diameter.

A small fitment, not shown on the drawings, is a small spring and anchor hook, which can be plainly seen in photographs Nos. 3 and 4, the hook being attached to the right-hand end of the chime release magnet by [redacted] small set-screw, and the spring hooked on to the control lever, [redacted] small notch being filed in the lever to stop the spring slipping. The spring is quite a light tension one, and is just sufficient to lift the hack[redacted] insert into the slots, and separate the contact points.

Locking Catch

This catch is shown on the drawing, and was made from softened hacksaw blade. The one I have drawn is differently mounted from the one shown in the photographs, but should be simpler and quite as efficient.

The pillar for locking plate is also shown on the drawing, and is made from [redacted] piece of $\frac{3}{16}$ in. diameter silver-steel to the dimensions shown, The top spigot to act as a bearing for the catch. could be hardened if required, and should be left [redacted] thou. or two longer than the thickness of the catch, and secured with [redacted] No. 8 B.A. set-screw and washer. A $\frac{1}{16}$ in. diameter hole is drilled through the pillar [redacted] shown, and a wire spring anchor made to take the outer end of the small tension spring which keeps the catch up to its work.

As mentioned early in this article, the chiming gear was mounted on a steel plate $6\frac{1}{2}$ in. $\times$ 5 in. $\times$ $\frac{1}{8}$ in. in thickness, the corners of this being rounded, and the various components being screwed on from the rear, with the exception of the release magnet, and the bearing for the control disc.

This method of fixing allows for the holes in the plate to be slightly slotted, for easy adjustment of the various parts.

The brackets supporting the release magnet also had slotted holes, to enable adjustments to be carried out.

Cheese-head set-screws, and washers were used to fasten the various parts to the plate, and consequently clearance holes had to be made in the clock baseboard to clear these.

It is hoped that sufficient details have been given to enable readers to construct [redacted] chiming gear similar to the one illustrated, but as it is most likely that readers will have their own ideas as to its arrangement, and also probably use other gears and improvise in many ways, it was thought that it would be superfluous to give the setting out of the holes in the baseplate, etc.

It will be noted that the chime drum spindle has [redacted] reduced portion at near its centre. This was to enable clearance for as large [redacted] control disc as could be managed using the " Meccano " two-to-one reduction gears, as shown.

Chiming Rods, Bracket and Clamp

The chiming-rods in the present case, were made from bronze welding-rod, and were $\frac{3}{16}$ in. diameter and to approximately the lengths shown on the drawing, measured to top of clamp.

The bracket was made from [redacted] piece of $\frac{1}{4}$ in. thick angle-iron, to the sizes shown, and the clamp for the rods was mounted on the inside, bottom edge, the angle-iron being drilled and tapped No. 2 B.A. to suit the holes in the clamp.

The clamp for the rods was made from $\frac{3}{8}$ in. square silver-steel, to the dimensions shown, and after drilling the holes for the clamping-screws, and the holes to accommodate the rods, it was split in two, lengthwise, as shown.

This clamp was held in position with five No. 2 B.A. cheese-head set-screws, and when the rods were in position, these set-screws were screwed up really hard, as it seems most necessary for the rods to be clamped up tightly to get the best results.

A set of rods had been made up from $\frac{1}{8}$ in. diameter bronze, and I think that these worked quite as well as the $\frac{3}{16}$ in. diameter ones.

The lengths of these from the top of the rods to the top surface of the clamp was $10\frac{1}{4}$ in., 9 in., $8\frac{5}{8}$ in. and $8\frac{1}{8}$ in.

I tried to get some information about these chiming rods, but all I could discover was an answer to [redacted] query in THE MODEL ENGINEER, and dated June 29th, 1933.

I quote from this reply :—

" (A) For the vibrating wires the following is approximate : use hard drawn phosphor bronze wire, No. 12 s.w.g. The Westminster Chimes can be produced on wires of total lengths of $7\frac{1}{4}$ in., $7\frac{3}{4}$ in., 8 in. and $9\frac{3}{16}$ in., each [redacted] held rigid by $\frac{1}{2}$ in. of its length at one end.

" Work the lengths [redacted] shade long, and file down to tune.

" Given in the order they chime the first quarter thus : C sharp, B.A.E.

" From the point where they [redacted] held rigid, the first one projects $6\frac{3}{4}$ in., and the others in the proportion given. Exactly from where they project they are shouldered down to about half diameter, and they taper up to full size in about 1 in., and they are struck at the top of this taper or near.

" They must be held rigidly in a bracket, firmly screwed to [redacted] wood panel, or something similar, to act as [redacted] diaphragm or sound board."

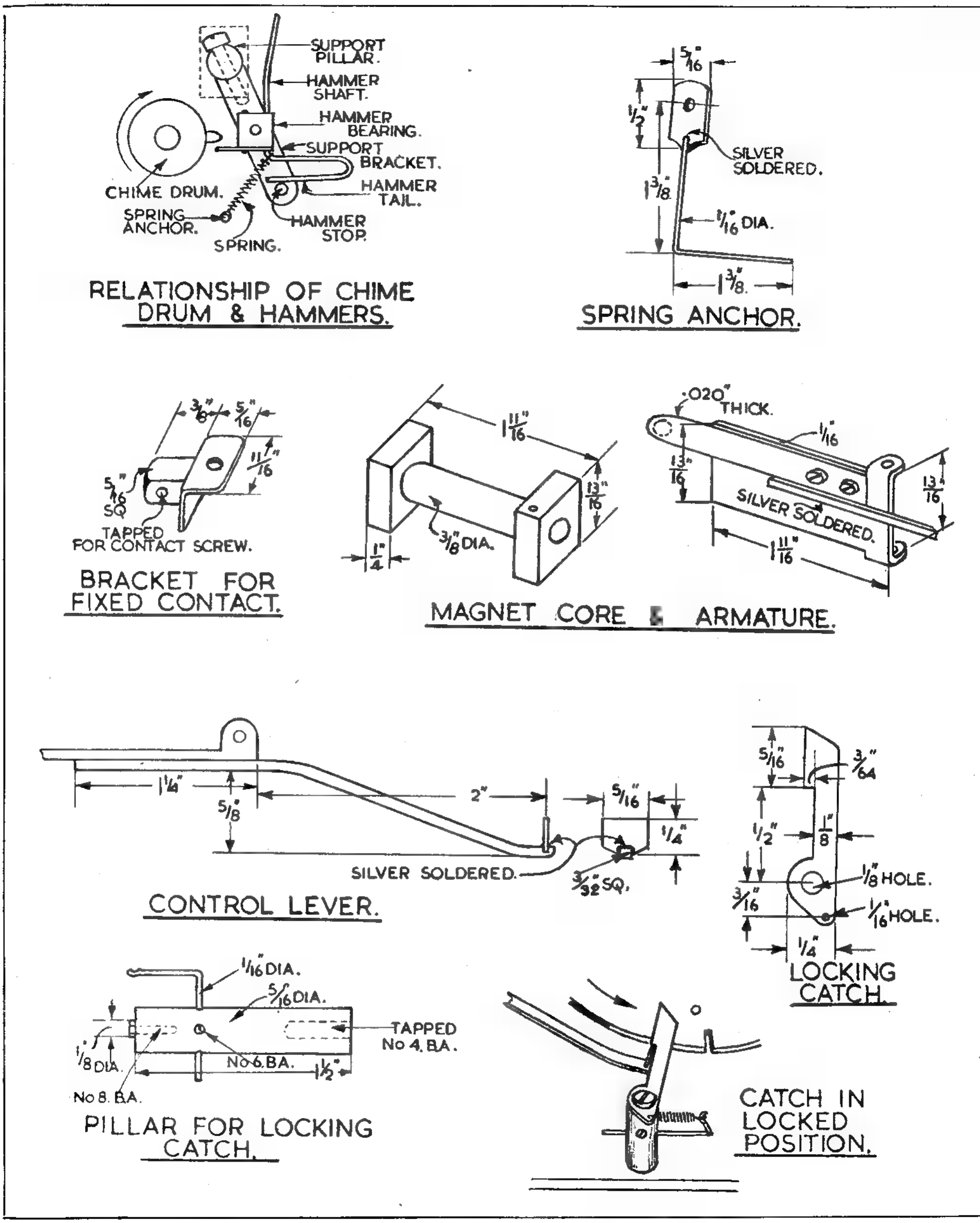
I myself found that when the bracket was firmly screwed or bolted to the clock backboard, the chimes seemed dead, and after a bit of experimenting they were bolted to the backboard with two $\frac{1}{4}$-in. bolts, two rubber washers about $\frac{3}{8}$ in. thick being inserted between the bracket and the backboard.

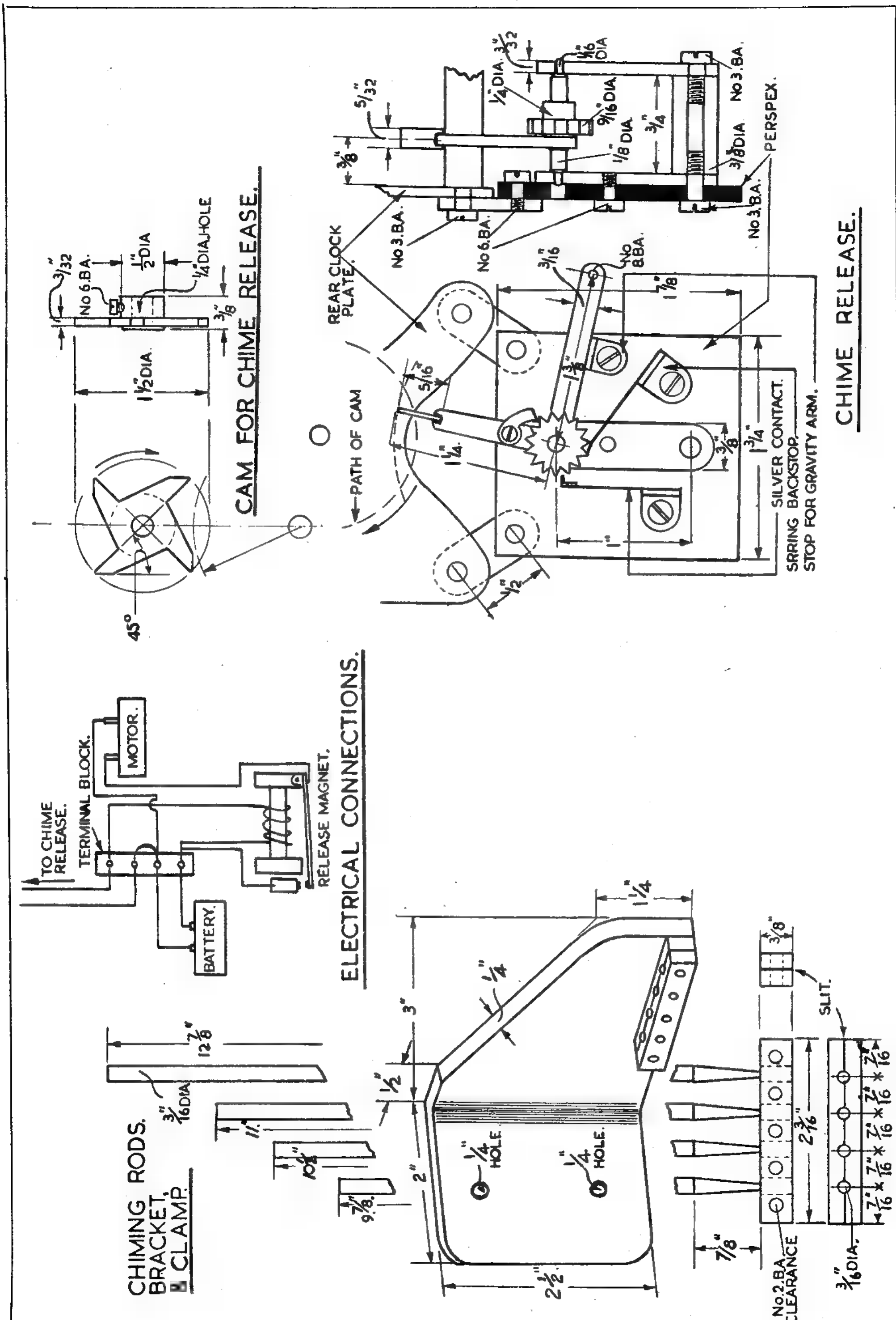
This seems to have done the trick, and the chimes can be heard all over the house.

I should mention that the bracket must not be allowed to touch the clockcase ; mine has about $\frac{1}{8}$ in. clearance from it.

For the smaller diameter rods, leather inserts in the hammer heads were quite satisfactory, but when the thicker rods were installed it was found necessary to fit the hammers with red fibre inserts.

The tails of the hammers are so adjusted that when they are resting on the hammer stop, the hammer inserts are about $\frac{1}{16}$ in. from the rods.




CHIMING RODS. BRACKET, & CLAMP.
ELECTRICAL CONNECTIONS.
CAM FOR CHIME RELEASE.
CHIME RELEASE.
TO CHIME RELEASE.
TERMINAL BLOCK.
MOTOR.
RELEASE MAGNET.
BATTERY.
REAR CLOCK PLATE.
PATH OF CAM
SILVER CONTACT.
SRRING BACKSTOP.
STOP FOR GRAVITY ARM.
PERSPEX.
No 3.BA.
No 6.BA.
No 8.BA.
No.2.BA. CLEARANCE
SLIT.
1/4" HOLE.
1/4" DIA HOLE
1 1/2" DIA.
45°
3/16" DIA.

When the notes are struck, there is enough spring in the hammer tails and shafts, to enable the hammers to strike the rods and immediately jump back, which allows the notes to hang on.

Chime Release

The chime release has been left until the last, and it [redacted] the last thing I made for my clock, mainly because I was under the impression that it was going to be quite an easy matter to fit [redacted] pair of contacts which the clock would close every quarter of an hour.

The cam for this chime release was made, in my case, from [redacted] short end of phosphor bronze rod, to the dimensions shown on the drawing, and fitted with [redacted] No. 6 B.A. set-screw, for locking it on to the centre spindle of the clock wheelwork, directly behind the centre wheel, on the sleeve (*D* in clock article).

This cam, of course, revolves once in each hour, and releases the chime release at each quarter.

The drawings show the arrangement, which has been working quite satisfactorily, and is purely mechanical in action.

The chime release is suspended under the clock wheelwork, on two brass link-pieces as shown, and which are placed behind the rear clock plate, and held in position by two slightly longer set-screws going into the lower pillars than the ones originally fitted.

The release consists of almost a square piece of Perspex $\frac{1}{8}$ in. in thickness and to the sizes shown. On this is mounted [redacted] small brass plate $\frac{3}{8}$ in. in width, and 3/32 in. in thickness, and directly above this (not shown on plan view) a similar plate is supported on a $\frac{3}{8}$ in. diameter pillar. At the open ends of these plates, two $\frac{1}{16}$ in. diameter holes form bearings for the short $\frac{1}{8}$ in. diameter spindle, with its ends turned down to form $\frac{1}{16}$ in. diameter pivots. Fixed to this spindle, where shown, is [redacted] right-angular gravity arm, having at its upper end [redacted] brass insert which was silver-soldered in position, and lower down [redacted] small steel pawl, which pawl engages with the teeth (fifteen in number) of a specially made brass wheel which is free to rotate on spindle, but is kept in position by the short $\frac{1}{4}$ in. diameter sleeve, pressed on.

The clockwise rotation of the gravity arm and spindle is limited by the stop, as shown, which is just [redacted] brass right-angle bracket, secured to the Perspex by a set-screw and washer, the Perspex being threaded for this purpose, and the hole in bracket slotted for [redacted] limited amount of adjustment.

A silver contact mounted on [redacted] light piece of spring steel, and soldered to another brass bracket similarly secured [redacted] the stop before mentioned, is so adjusted as to just touch the ends of the teeth if the wheel is revolved.

The spring back-stop is similarly mounted to the other two fittings, and consists of a length of 0.006 in. feeler blade $\frac{1}{8}$ in. width, which is soldered to its supporting bracket, and is so adjusted as to hold the wheel when at rest [redacted] that the silver contact is midway between two of its teeth.

The action is [redacted] follows: As the cam on the centre spindle revolves, (the chime release being mounted [redacted] shown) the top end of the gravity arm is moved to the left, the pawl riding over the teeth of the wheel without turning it, but when the particular quarter hour arrives, the top of the arm slips off the end of cam, and the portion of the arm to the right drops on to its stop, the pawl moving the wheel round one tooth.

The No. [redacted] B.A. tapped hole in the end of gravity arm is so that [redacted] small amount of extra weight can be added if necessary.

It will be seen from the foregoing that when the wheel moves one tooth, it will make contact with the silver contact in doing so, also the arm is now on its stop, and is reset for the next contact.

The spring back-stop, and the pillar holding the plates are connected together and form one side of the switch, and the bracket supporting the silver contact forms the other side.

Five other arrangements were made which on test proved to be quite useless, and it took about five weeks spare time to get this part of the business working satisfactorily.

If the diagram of the electrical connections is studied it will be seen that if the two wires shown "to chime release" are connected as explained above, when the quarter hour arrives and the wheel on chime release moves one tooth, [redacted] very short impulse will go *via* the terminal block and battery to the release magnet, this will attract its armature, closing the points, and lifting the control lever out of the slot it happens to be in, and at the same time the locking catch will come into operation and prevent the end of lever dropping back into the slot.

As the contacts have closed, the motor will be rotating, driving the chime drum and hammers, and also rotating the control disc.

The pins on the control disc will soon unlock the catch and let the end of the arm drop on to the outside edge of disc, the contacts still being closed until the chime has played, when the insert in the end of the arm will drop into the next slot, and switch off the motor ready for the same cycle of operations at the next quarter.

The gravity arm requires to be made as lightly as possible, with just enough weight to overcome the friction of the contact, and the spring back-stop.

The two holes in the top of the Perspex will probably have to be slotted, to get the whole arrangement at just the right height for the cam to move the gravity arm the correct amount to pick up one tooth at [redacted] time.

I think it highly probable that readers will find [redacted] much simpler arrangement to do this work just as well, and probably better, and I hope readers will be interested enough to have [redacted] go at [redacted] chiming gear, either like the one I have described, or one of their own design, or with modifications of their own.

I have found the job very fascinating, both to make, and also to watch working.

The original case has been lengthened by six in. and [redacted] glass front fitted, so that the whole chiming gear can been seen.

Well, readers, I shall be glad to give any further information I can *via* the Editor of "Ours." Good Chiming!

"L.B.S.C.'s" Lobby Chat

"Chopping 'em Off"

A LETTER received from a comparatively new reader, raises certain points which may be of interest to newcomers to our craft, so may be a little chinwag on the subject here, won't come amiss. Our friend had the chance of buying a used locomotive at a quite reasonable price; and the vendor, who had an excellent reason for wishing to sell, quite fairly offered to let the prospective purchaser see the engine in steam before deciding to purchase. The offer was accepted; the engine seemed to do the specified job all right on a short straight line, and the deal was duly completed. The purchaser now finds that if the locomotive is put to work on a continuous line, she has some difficulty in maintaining pressure; not too bad when the pump is not feeding, but an influx of cold water makes the pressure drop, whilst the coal consumption is rather "spam-cannish" in proportion to the work done. The engine is not built to my complete specifications; but the builder told the purchaser he had incorporated in her, the principles set forth in these notes, and frankly stated that she had never run on a continuous road. The purchaser states that this has puzzled him quite a lot, as other locomotives with boilers, cylinders, and driving wheels of similar size, seem to have no difficulty in running nonstop on the same track "till the cows come home," needing much less firing than his own engine. If I could give him any clue to the cause of his own engine's lack of "pep," without actually seeing and testing her, he would be very grateful.

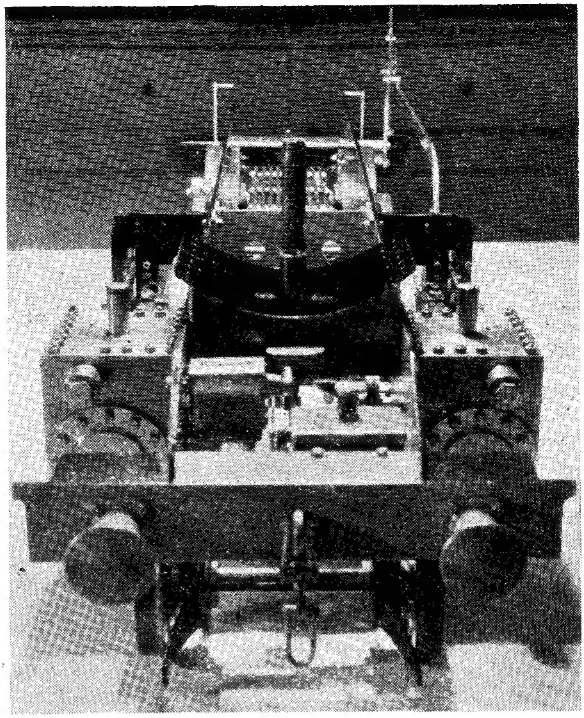
A Clue

In my first reply, I asked for particulars of how the engine behaved when she was actually running with a moderate load, and if he noticed anything when starting, such as intermittent wheezing, uneven beats, and so on. Any full-size driver who knows his job, can usually diagnose quite a lot of locomotive faults and failings, merely by certain sounds an engine will make, both at starting, and on the run; and the same applies to a little one—at least, I have found that the little lassies will voice their complaints in exactly the same way as their full-sized relatives. Our friend says that there is no appreciable wheeze or blow; he has already repacked the glands, and cannot see any sign of a steam leak, either from piston or spindle glands. The exhaust beats are slightly uneven when first starting from rest, but as soon as the engine gets going, the slight irregularity isn't discernible. He adds that she has a tremendous bark, and starts off as if she fully intends to run from Euston to Carlisle without a stop, but gets rather tired before reaching Watford. He thinks the loud beats are a good feature, as she "chops 'em off" as well, if not better, than any other similar engine he has seen at work. They are good hearty deep-tone puffs; of the same kind, to his way of thinking, that I have mentioned in these notes as being desirable, and he cannot imagine why the engine should lose pressure with such a blast to urge the fire. Aha! thought Curlylock Holmes when reading the letter; here's the clue I've been waiting for—*now* we know where to put our fingers bang on to the culprit!

There is a Difference

As I have remarked previously, it isn't the *amount* of steam leaving the blast nozzle, which creates the best draught, but the speed at which it shoots up the chimney. Quite a wisp of steam, ejected from the blast nozzle with plenty of "Sunny Jim" behind it, will have more effect in drawing up the fire, than a whole cylinderful, which takes longer to get out of the nozzle, and fills up the chimney liner. By the same token, says Pat, that little wisp will make a sharp snappy "crack" as it shoots out, whilst the "full pot" will make a ponderous sort of "wuff"; a different note altogether. As it is usually much louder than the "crack," uninitiated folk are prone to regard it as a good feature, and imagine that it denotes efficiency. But as with human beings, so with locomotives. The man who has a terrible lot to say for himself, may sound very convincing to the majority of people, who accept him at his face value—or maybe I should say "sound" value; whereas his actual percentage of efficiency is pretty low. Another kind of person doesn't say a great deal, but what he—or she—does say, is the outcome of practical experience, and a few of the latter's words are worth a bookful of the former's. The locomotive with the heavy blast may also sound very convincing, to anybody who hasn't had a great deal of experience with railway engines; actually, it is wasting its energy. It is the engine with the sharp snappy crack, that is on the top notch of efficiency. The other evening, time of writing, I was getting up steam on one of my own engines, for a run on my little railway, when an up parcels train, headed by one of the new L.M.S.-type 2-6-4 tanks, was stopped by signal right opposite; the driver and fireman looked down, and waved, as they usually do. The signal cleared, there was a toot from the engine's hooter, and she moved off with a succession of sharp whip-like cracks, not too loud, from her shapely little chimney, that were a real joy to hear. I mentally compared them with the heavy and loud beats of the old Billinton radial tanks on the L.B. & S.C. Ry. in bygone days, which made a terrible lot of noise and fuss, but hadn't so much to show for it; and was still "back in the past" when my own little engine imperiously called me down to earth, by starting to blow off like nobody's business, as though she was anxious to be away on her run.

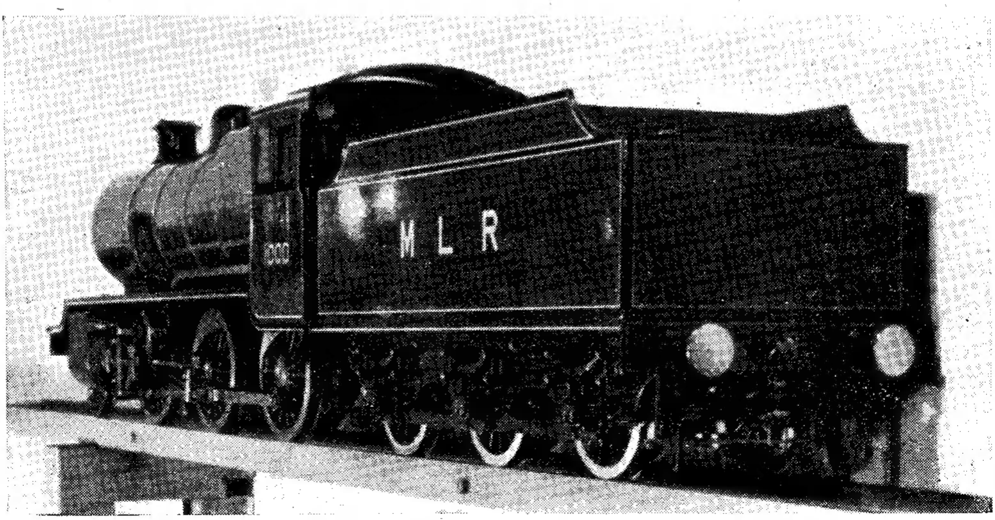
She soon was—and the little spitfire cracks that came from the wee chimney as she started away, were the living echo of her big sister's.



The 5-in. gauge "Dyak" under construction

Causes of Trouble

I wrote to my correspondent and told him that the trouble was due to his locomotive wasting steam instead of making the best use of it, and made the following suggestions. Take off the steam-chest covers and carefully check the valve setting, and in doing this, compensate for steam pressure on the end of the valve spindle, by pressing against it with a piece of wire whilst turning the wheels by hand. This takes up any slack in the valve-gear. I remember on one occasion, when a first-timer had built an engine to a specification published in the earlier days of these notes, he complained that although he had followed implicity the details of the valve-setting operation, his engine gave uneven beats, and one of them disappeared altogether when an attempt was made to notch up. This was due to his inexperienced workmanship. He had done his best, but owing either to his drills and reamers "cutting large," or from using undersized steel for the pins in the motion, (probably a combination of both) there was nearly $\frac{1}{16}$ in. backlash on the valve spindles. He had set the valves by turning the wheels and watching the valves, to see that the ports cracked on dead centres, as per instructions; but he didn't realise, or perhaps didn't know, that turning the wheels by hand and letting the motion drag the valve, in a manner of speaking, is a different proposition from what obtains under working conditions with a slack or even "sloppy" valve-gear. When the engine was in steam, the pressure on the end of the valve spindle forced it out, and took up all the slack in the gear; consequently, when he fondly imagined that the port had just cracked, same



Mr. C. M. Rostron's 5-in. gauge "Dyak"

as when he was watching the events with the steam-chest cover off, actually the port was opened to an amount equal to the combined slack of all the pin joints. This caused a too early opening, and an incorrect cut-off point.

Beginners would be well advised to take particular note of the above, especially if they are building *Tich*. If the pins are not an exact fit in the holes in the valve gear components, there will be backlash at the valve spindle ; and if so, the "set-by-sight" method previously given, will only apply if the valve spindle is pressed outwards whilst doing the actual setting, so as to take up any slack that may be present in the gear.

This is one reason why I sometimes advocate setting valves under pressure, as with *Doris* and other piston-valve engines for which cylinder drain cocks are called for in the instructions. The pressure automatically takes up any slack in the valve-gear, same as when the locomotive is actually at work. There is another thing which many good folk don't realise, judging from conversation and correspondence. It is fondly imagined that an internal-admission piston-valve is always in a state of equilibrium (third programme again—aren't I going posh !) by virtue of pressure between the bobbins "moving it not to the right or left," as somebody whose moniker has slipped my memory (not so posh !) once wrote. Well, don't you believe it ! As soon as the outside edge of the bobbin opens the port to exhaust, out comes the steam in a terrific hurry, and fills the space between the end of the bobbin and the steam-chest cover ; and if there is any slack in the valve-gear, the piston-valve, due to the pressure on the bobbin, will move over as far as it can, and take up that slack. The piston-valve is only in a state of what I said before, when there is no pressure at either end of it.

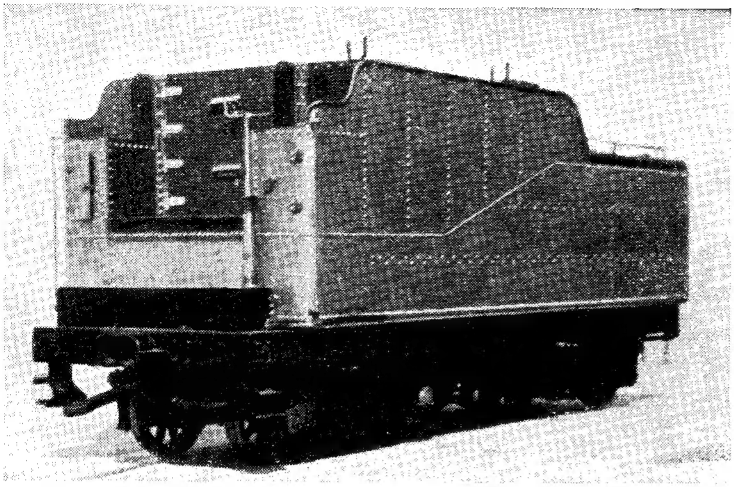
The Remedy

I told my correspondent that if the port did not crack on dead centre with the valve-gear slack taken up as advised, or if it opened too much, to make the necessary adjustment on the valve-spindle ; after which, check off the closing point. If this took place *after* the piston had travelled three-quarters of the stroke, when the motion was in full gear, the valves were too short ; and a new pair, slightly longer, would be needed, the amount of lap being almost equal to the port width. This would allow for trimming back a shade, to bring the full gear cut-off to approximately 70 per cent. of the stroke. Whilst on the job, the port-faces and valves should be trued up, and the pistons repacked. If there were any very bad pin joints in the valve-gear, they should be renewed, by reaming or re-drilling the holes a shade larger, and fitting pins to suit. Ordinary wear could be counteracted by setting the valves with pressure applied to the end of the spindle, as above. When reassembling, make certain that there were no tight places, and that the mechanical lubricator was functioning as it should do. The engine should then steam and pull in the manner usually observed among well-bred locomotives, with no loss of steam pressure when the pump was feeding, and on quite a small quantity of coal. The beats should not be "terrific barks," but sharp staccato cracks, with no sign of wheezing in between.

Up to the time of writing, I have not heard if the recommendations have been followed out, nor what my correspondent found when he investigated matters ; but I'm open to bet that the cut-off was something like 95 per cent., and the port opening much too late. There are still a lot of misguided folk who persist in clinging to the late-opening-negative-lead fallacy, and it is quite possible that the original builder of the engine may have held those views. A late port-opening means a late cut-off, which in turn results in a cylinder almost completely filled with steam at very little below boiler pressure ; the late cut-off doesn't allow for expansion. Consequently, as soon as the port opens to exhaust, this mass of steam has to get away through the exhaust pipe, and not only causes the terrific bark, but puts back-pressure on the piston as well, partly neutralising the pressure of the incoming steam on the other side of the piston, and so reducing its effective power. With my recommended ports, valves, and valve setting, the exhaust—what there is of it !—has completely gone by the time the piston reaches the end of its stroke ; and the early admission at the opposite end, has built up enough pressure on the piston head, to take full advantage at the instant the crank is over dead centre.

In the case of my correspondent's engine, the passage-ways between the ports and the cylinder bore, were all right, but for new readers' benefit, it will bear repeating that even an engine with my recommended ports, valves, and setting, will waste steam to an incredible extent if the passage-ways are too large. The ideal passage-way is short, as direct as possible, and just large enough to pass in either direction (admitting and exhausting) the amount of steam necessary to run the engine at full speed with a normal load and early cut-off. This suffices also for slow and heavy pulling, as the greater volume of steam required, then has plenty of time to get through.

The old idea of a long passage-way, the full area of the port, is a fallacy, inasmuch as it has to be filled with steam at or near boiler pressure before the steam can exert that same pressure on the piston, and then blown away to waste, without doing any work, as soon as the port opens to exhaust. This also produces the "terrific bark," which causes intense draught, burning up more coal, to generate more steam, to be blown to waste in its turn ! It reminds me of the driver who stopped for a signal, right alongside an Italian labourer who was digging a channel alongside the line. "Hallo, Antonio," said the driver, "what are you doing now ?" "I digga da ditch," replied Antonio. "What's it for ?" said the driver, meaning what was the channel for. Antonio misunderstood him, and as the signal cleared, he called out, "I digga da ditch, to getta da mon, to buy a da macaroni, to maka da muscle—to digga da ditch !" And that was where we came in, so to speak.



Mr. D. F. Holland's 3½-in. gauge S.A.R. tender

Big Sister's Troubles

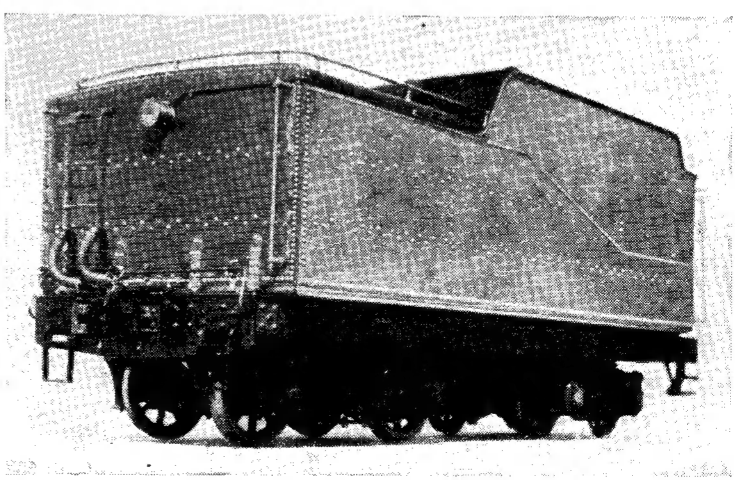
It is curious, though perhaps natural in a way, that in addition to the fact that little locomotives will give indications of trouble in the same way as their full-size relations, they will also exhibit the same characteristics, sometimes to a marked degree. For example, nobody will question the overall efficiency of the Swindon type of boiler. All the small boilers of the same type that I have built, have been wonderful steamers, evaporating more water per pound of coal consumed, than boilers of similar size, with parallel barrels and round-backed fireboxes. Conversely, if a big engine proves sluggish in starting and running, and a shy steamer, the odds are a million dollars to a pinch of snuff, that a little one built after the same style, will prove to act in similar manner—that is, of course, unless inherent faults are eliminated, as with my *Jeanie Deans*. . . .

An illustration of this took place not so long ago, on my own little railway. Two or three years ago, the members of the North London S.M.E. kindly elected your humble servant patron of the club. In appreciation, I let "the boys" bring locomotives over now and again, to try out on my road. One of them has built a 3½-in. gauge Drummond "paddlebox" 4-6-0, complete with four cylinders, and all the usual blobs and gadgets. She would certainly delight the heart of old Dugald, if he could only see her. Incidentally, I only wish Francis Webb could see my *Jeanie* at work. Well, the little "paddlebox" performed absolutely true to life—but she won't do it for long, because I've given the builder a few "'ints and tipses" on how to improve her performance; and unless I miss my guess, she will be showing the spam cans how to do it, when she next comes over. This, by the way, was another instance of a builder being deceived by a loud blast. He thought the beats were O.K. They were even enough, but I knew she was wasting steam, directly I heard her puff; and with the shallow firebox of the type of boiler fitted to this class of engine, you can't afford to waste any, though the boiler will provide ample steam for the four cylinders, if the engine part is in proper fettle.

Two Good Jobs

Our picture gallery this week, portrays two examples of patience and perseverance,

The first is a *Dyak* type 2-6-0, built to double size, 5-in. gauge, by ex-Flying Officer M. Rostron, who did his bit in the Battle of Britain and elsewhere. It is a first attempt at locomotive building, and our friend says she is a complete vindication of the principles and methods set forth in these notes. She has taken a long time to build, but the result was worth it. As Mr. Rostron had no facilities for building a 5-in.



A "staggering" job of riveting!

gauge-sized boiler, old Tommy Goodhand (our oldest advertiser) attended to that part of the business, making the boiler twice the size of the one described for the $2\frac{1}{2}$-in. gauge job some 17 or so years ago. I believe it was the "Flying Squad"—not the Scotland Yard variety—who originated the saying about "a piece of cake"; and our friend has certainly cut himself a generous helping for his second attempt at locomotive building, for he has started a 5-in. gauge version of the Timken 4-8-4. I sent him some $2\frac{1}{2}$-in. gauge blueprints to double up, as he was unable to obtain any of the full-size job. The length of the proposed engine exceeds 8 ft., and it will be all of two persons' work to lift her. Anyway, I heartily wish friend Rostron all success in his project; she should be real wizard!

I often have a friendly crack at the boys who love to see millions of little pimples adorning their engines; one reason being that I'm jealous, really, being too darn lazy to do a similar job myself! However, that doesn't detract from my admiration of the work of those who can do a proper job of riveting; and here you see a fine example. The tender is the handiwork of Mr. D. F. Holland, who is busy on a South African Railways class 15 CA locomotive to 1-in. scale, which is $3\frac{1}{2}$-in. gauge, the S.A.R. having a gauge of 3 ft. 6 in. only. There is no need for me to dilate on the job—good wine needs no bush, and the photographs illustrate the quality of the workmanship. Our friend certainly has an exceedingly straight eye! The complete engine, built to the same high standard, should prove to be what the kiddies would call "a real smasher."

PRACTICAL LETTERS

Criticism—And Counter-Criticism!

DEAR SIR,—May I be allowed to say a few words in my own defence against the wrath of Mr. E. M. T. Thomas, as expressed in the issue dated July 26th? If he will read my letter again he will see that I stated, and I repeat here, that I have the greatest admiration for the work of "Duplex." My complaint was that a certain device carried the love of gadgets too far, in my honest opinion.

Concerning my anecdote, Mr. Thomas has missed the whole point. I see no reason why I should have given the name of the speaker, but the fact is that I never knew it; he was, and is, a perfect stranger. He was obviously under the impression that one did the work while the other wrote about it, and his question was clearly asked in all sincerity. It was certainly not a "wisecrack," whatever (or should it be whateffer?) that may be.

The remarks about surgery are not *ad hoc*; I never questioned for a moment the mechanical skill of "Duplex" in fact, I praised it. In spite of this, I would not let them amputate any of my fingers. They might rig up my old friend in Fig. 6 and machine it off with an end-mill!

In conclusion, my best respects to "Duplex," may their double shadow never grow less, but let them be warned lest another crack like "Fig. 6" should cause the gods to look down from Olympus and blast them with thunderbolts!

Yours faithfully,

New Eltham. A. L. HUTTON.

Waterproof Adhesives

DEAR SIR,—We were most interested to read Mr. P. W. Blandford's contribution on this subject.

There are, however, errors in regard to the information published on our CASCO-RESIN adhesives, and we would inform you that the Separate Hardeners available are K-6, K-8, K-9 and K-10, the setting times being detailed in our Technical Service Bulletin No. 3C.

Also, unfortunately, the prices quoted are incorrect, and should be as follows:—

1-lb.	5s. 6d.
2-lb.	10s. od.
10-lb.	39s. od.

The prices quoted by your contributor are special prices applicable only where we sell our products to schools for use by handicraft instructors.

Yours faithfully,

LEICESTER, LOVELL & CO. LTD.

Southampton. F. H. GARSIDE.
Sales Manager.

Soldering Monel Metals

DEAR SIR,—I notice that in your issue of August 16th J. B. Millar mentions the difficulty of soldering "Monel" metal.

My experience is that using a 50 per cent. w/w solution of phosphoric acid as a flux and a normal multicored solder, no trouble was found. Johnson, Matthey's "Easy-flo" flux can be used with silver solder and gives an excellent joint.

It should be remembered that "Monel" alloy is resistant to a very large number of corrosive materials and is valuable for any experimental engineer.

Yours faithfully,

Ipswich. A. L. WHYNES (Ph.D.)

DEAR SIR,—I was rather interested in Mr. Millar's letter regarding the soldering of Monel metal. This metal is easily soldered with ordinary plumber's solder (60 lead, 40 tin mixing), and, using a neutral solution of zinc chloride as cleaning agent, the metal must be thoroughly cleaned with emery paper and it is also a good point to tin both surfaces to be joined. It is essential in all soldering jobs for the two metals to be joined to be brought up in temperature to the melting point of the solder being used, a point often forgotten. How Mr. Millar mistakes Monel metal for brass I cannot understand, as they are so different in colour.

Yours faithfully,

Norwich. S. A. DAINES.